INSTALLATION AND OPERATION MANUAL

# RICi-4E1/T1, RICi-8E1/T1

## Fast Ethernet over Four or Eight E1 or T1 NTUs

Version 2.0

EtherAccess

RAD

data communications

The Access Company

# RICi-4E1/T1, RICi-8E1/T1

Fast Ethernet over Four or Eight E1 or T1 NTUs

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Installation and Operation Manual

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For further information contact RAD at the address below or contact your local distributor.

| **International Headquarters**<br>**RAD Data Communications Ltd.** | **North America Headquarters**<br>**RAD Data Communications Inc.** |
|---|---|
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# Limited Warranty

RAD warrants to DISTRIBUTOR that the hardware in the RICi-4E1/T1, RICi-8E1/T1 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

If, during the warranty period, any component part of the equipment becomes defective by reason of material or workmanship, and DISTRIBUTOR immediately notifies RAD of such defect, RAD shall have the option to choose the appropriate corrective action: a) supply a replacement part, or b) request return of equipment to its plant for repair, or c) perform necessary repair at the equipment's location. In the event that RAD requests the return of equipment, each party shall pay one-way shipping costs.

RAD shall be released from all obligations under its warranty in the event that the equipment has been subjected to misuse, neglect, accident or improper installation, or if repairs or modifications were made by persons other than RAD's own authorized service personnel, unless such repairs by others were made with the written consent of RAD.

The above warranty is in lieu of all other warranties, expressed or implied. There are no warranties which extend beyond the face hereof, including, but not limited to, warranties of merchantability and fitness for a particular purpose, and in no event shall RAD be liable for consequential damages.

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DISTRIBUTOR shall be responsible to its customers for any and all warranties which it makes relating to RICi-4E1/T1, RICi-8E1/T1 and for ensuring that replacements and other adjustments required in connection with the said warranties are satisfactory.

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This Agreement shall be construed and governed in accordance with the laws of the State of Israel.

# Product Disposal

To facilitate the reuse, recycling and other forms of recovery of waste equipment in protecting the environment, the owner of this RAD product is required to refrain from disposing of this product as unsorted municipal waste at the end of its life cycle. Upon termination of the unit's use, customers should provide for its collection for reuse, recycling or other form of environmentally conscientious disposal.

# General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

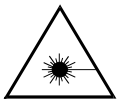
# Safety Symbols

***Warning***

This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.

Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.

Protective ground: the marked lug or terminal should be connected to the building protective ground bus.



***Warning***

Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached.

Please observe the following precautions:

- Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.
- Do not attempt to adjust the laser drive current.
- Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.
- The use of optical devices with the equipment will increase eye hazard.
- Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.

ATTENTION: The laser beam may be invisible!

In some cases, the users may insert their own SFP laser transceivers into the product. Users are alerted that RAD cannot be held responsible for any damage that may result if non-compliant transceivers are used. In particular, users are warned to use only agency approved products that comply with the local laser safety regulations for Class 1 laser products.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this product. No installation, adjustment, maintenance or repairs should be performed by either the operator or the user.

# Handling Energized Products

## General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective ground terminal. If a ground lug is provided on the product, it should be connected to the protective ground at all times, by a wire with a diameter of 18 AWG or wider. Rack-mounted equipment should be mounted only in grounded racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

Some products may have panels secured by thumbscrews with a slotted head. These panels may cover hazardous circuits or parts, such as power supplies. These thumbscrews should therefore always be tightened securely with a screwdriver after both initial installation and subsequent access to the panels.

## Connecting AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

In cases when the power distribution system is IT type, the switch must disconnect both poles simultaneously.

## Connecting DC Power

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC power systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC power supply is electrically isolated from any AC source and that the installation complies with the local codes.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Before connecting the DC supply wires, ensure that power is removed from the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated in the building installation.

If the DC power supply is floating, the switch must disconnect both poles simultaneously.

# Connecting Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

| Ports | Safety Status |
|---|---|
| V.11, V.28, V.35, V.36, RS-530, X.21, 10 BaseT, 100 BaseT, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M | SELV Safety Extra Low Voltage:<br>Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC. |
| xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1 | TNV-1 Telecommunication Network Voltage-1:<br>Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible. |
| FXS (Foreign Exchange Subscriber) | TNV-2 Telecommunication Network Voltage-2:<br>Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines. |
| FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN | TNV-3 Telecommunication Network Voltage-3:<br>Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible. |

**Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.**

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Extra caution should be exercised during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The grounding and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk, there are restrictions on the diameter of wires in the telecom cables, between the equipment and the mating connectors.

***Caution*** To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

***Attention*** Pour réduire les risques s'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

# Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good ground connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lock-washers and torque. If an external grounding lug is provided, connect it to the ground bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables. In such cases, special instructions are provided in the manual.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electro-static discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching ground or wear an ESD preventive wrist strap.

# FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

# Warning per EN 55022 (CISPR-22)

| | |
|---|---|
| ***Warning*** | This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures. |
| ***Avertissement*** | Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées. |
| ***Achtung*** | Das vorliegende Gerät fällt unter die Funkstörgrenzwertklasse A. In Wohngebieten können beim Betrieb dieses Gerätes Rundfunkströrungen auftreten, für deren Behebung der Benutzer verantwortlich ist. |

# Mise au rebut du produit

Afin de faciliter la réutilisation, le recyclage ainsi que d'autres formes de récupération d'équipement mis au rebut dans le cadre de la protection de l'environnement, il est demandé au propriétaire de ce produit RAD de ne pas mettre ce dernier au rebut en tant que déchet municipal non trié, une fois que le produit est arrivé en fin de cycle de vie. Le client devrait proposer des solutions de réutilisation, de recyclage ou toute autre forme de mise au rebut de cette unité dans un esprit de protection de l'environnement, lorsqu'il aura fini de l'utiliser.

# Instructions générales de sécurité

Les instructions suivantes servent de guide général d'installation et d'opération sécurisées des produits de télécommunications. Des instructions supplémentaires sont éventuellement indiquées dans le manuel.

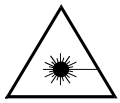
# Symboles de sécurité

***Avertissement***

Ce symbole peut apparaitre sur l'équipement ou dans le texte. Il indique des risques potentiels de sécurité pour l'opérateur ou le personnel de service, quant à l'opération du produit ou à sa maintenance.

Danger de choc électrique ! Evitez tout contact avec la surface marquée tant que le produit est sous tension ou connecté à des lignes externes de télécommunications.

Mise à la terre de protection : la cosse ou la borne marquée devrait être connectée à la prise de terre de protection du bâtiment.



***Avertissement***

Certains produits peuvent être équipés d'une diode laser. Dans de tels cas, une étiquette indiquant la classe laser ainsi que d'autres avertissements, le cas échéant, sera jointe près du transmetteur optique. Le symbole d'avertissement laser peut aussi être joint.

Veuillez observer les précautions suivantes :

- Avant la mise en marche de l'équipement, assurez-vous que le câble de fibre optique est intact et qu'il est connecté au transmetteur.
- Ne tentez pas d'ajuster le courant de la commande laser.
- N'utilisez pas des câbles ou connecteurs de fibre optique cassés ou sans terminaison et n'observez pas directement un rayon laser.
- L'usage de périphériques optiques avec l'équipement augmentera le risque pour les yeux.
- L'usage de contrôles, ajustages ou procédures autres que celles spécifiées ici pourrait résulter en une dangereuse exposition aux radiations.

ATTENTION : Le rayon laser peut être invisible !

Les utilisateurs pourront, dans certains cas, insérer leurs propres émetteurs-récepteurs Laser SFP dans le produit. Les utilisateurs sont avertis que RAD ne pourra pas être tenue responsable de tout dommage pouvant résulter de l'utilisation d'émetteurs-récepteurs non conformes. Plus particulièrement, les utilisateurs sont avertis de n'utiliser que des produits approuvés par l'agence et conformes à la réglementation locale de sécurité laser pour les produits laser de classe 1.

Respectez toujours les précautions standards de sécurité durant l'installation, l'opération et la maintenance de ce produit. Seul le personnel de service qualifié et autorisé devrait effectuer l'ajustage, la maintenance ou les réparations de ce produit. Aucune opération d'installation, d'ajustage, de maintenance ou de réparation ne devrait être effectuée par l'opérateur ou l'utilisateur.

# Manipuler des produits sous tension

## Règles générales de sécurité

Ne pas toucher ou altérer l'alimentation en courant lorsque le câble d'alimentation est branché. Des tensions de lignes peuvent être présentes dans certains produits, même lorsque le commutateur (s'il est installé) est en position OFF ou si le fusible est rompu. Pour les produits alimentés par CC, les niveaux de tension ne sont généralement pas dangereux mais des risques de courant peuvent toujours exister.

Avant de travailler sur un équipement connecté aux lignes de tension ou de télécommunications, retirez vos bijoux ou tout autre objet métallique pouvant venir en contact avec les pièces sous tension.

Sauf s'il en est autrement indiqué, tous les produits sont destinés à être mis à la terre durant l'usage normal. La mise à la terre est fournie par la connexion de la fiche principale à une prise murale équipée d'une borne protectrice de mise à la terre. Si une cosse de mise à la terre est fournie avec le produit, elle devrait être connectée à tout moment à une mise à la terre de protection par un conducteur de diamètre 18 AWG ou plus. L'équipement monté en châssis ne devrait être monté que sur des châssis et dans des armoires mises à la terre.

Branchez toujours la mise à la terre en premier et débranchez-la en dernier. Ne branchez pas des câbles de télécommunications à un équipement qui n'est pas mis à la terre. Assurez-vous que tous les autres câbles sont débranchés avant de déconnecter la mise à la terre.

## Connexion au courant du secteur

Assurez-vous que l'installation électrique est conforme à la réglementation locale.

Branchez toujours la fiche de secteur à une prise murale équipée d'une borne protectrice de mise à la terre.

La capacité maximale permissible en courant du circuit de distribution de la connexion alimentant le produit est de 16A. Le coupe-circuit dans l'installation du bâtiment devrait avoir une capacité élevée de rupture et devrait fonctionner sur courant de court-circuit dépassant 35A.

Branchez toujours le câble d'alimentation en premier à l'équipement puis à la prise murale. Si un commutateur est fourni avec l'équipement, fixez-le en position OFF. Si le câble d'alimentation ne peut pas être facilement débranché en cas d'urgence, assurez-vous qu'un coupe-circuit ou un disjoncteur d'urgence facilement accessible est installé dans l'installation du bâtiment.

Le disjoncteur devrait déconnecter simultanément les deux pôles si le système de distribution de courant est de type IT.

## Connexion d'alimentation CC

Sauf s'il en est autrement spécifié dans le manuel, l'entrée CC de l'équipement est flottante par rapport à la mise à la terre. Tout pôle doit être mis à la terre en externe.

A cause de la capacité de courant des systèmes à alimentation CC, des précautions devraient être prises lors de la connexion de l'alimentation CC pour éviter des courts-circuits et des risques d'incendie.

Les unités CC devraient être installées dans une zone à accès restreint, une zone où l'accès n'est autorisé qu'au personnel qualifié de service et de maintenance.

Assurez-vous que l'alimentation CC est isolée de toute source de courant CA (secteur) et que l'installation est conforme à la réglementation locale.

La capacité maximale permissible en courant du circuit de distribution de la connexion alimentant le produit est de 16A. Le coupe-circuit dans l'installation du bâtiment devrait avoir une capacité élevée de rupture et devrait fonctionner sur courant de court-circuit dépassant 35A.

Avant la connexion des câbles d'alimentation en courant CC, assurez-vous que le circuit CC n'est pas sous tension. Localisez le coupe-circuit dans le tableau desservant l'équipement et fixez-le en position OFF. Lors de la connexion de câbles d'alimentation CC, connectez d'abord le conducteur de mise à la terre à la borne correspondante, puis le pôle positif et en dernier, le pôle négatif. Remettez le coupe-circuit en position ON.

Un disjoncteur facilement accessible, adapté et approuvé devrait être intégré à l'installation du bâtiment.

Le disjoncteur devrait déconnecter simultanément les deux pôles si l'alimentation en courant CC est flottante.

# Declaration of Conformity

| | |
|---|---|
| **Manufacturer's Name:** | RAD Data Communications Ltd. |
| **Manufacturer's Address:** | 24 Raoul Wallenberg St., Tel Aviv 69719, Israel |

declares that the product:

| | |
|---|---|
| **Product Name:** | RICi-8E1, RICi-4E1 |

conforms to the following standard(s) or other normative document(s):

| | | |
|---|---|---|
| **EMC:** | EN 55022:1998 + A1:2000, A2:2003 | Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement. |
| | EN 55024:1998 + A1:2001, A2:2003 | Information technology equipment – Immunity characteristics – Limits and methods of measurement. |
| **Safety:** | EN 60950-1:2001 | Information technology equipment – Safety – Part 1: General requirements. |

**Supplementary Information:**

The products herewith comply with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC and the R&TTE Directive 99/5/EC for wired equipment. The products were tested in a typical configuration.

Tel Aviv, 7 November 2006

Haim Karshen

VP Quality

**European Contact:** RAD Data Communications GmbH, Otto-Hahn-Str. 28-30, 85521 Ottobrunn-Riemerling, Germany

# Glossary

| | |
|---|---|
| **Address** | A coded representation of the origin or destination of data. |
| **Agent** | In SNMP, this refers to the managed system. |
| **Analog** | A continuous wave or signal (such as human voice). |
| **ANSI** | American National Standards Institute. |
| **AWG** | The American Wire Gauge System, which specifies wire width. |
| **Backhaul** | Transporting traffic between distributed sites (typically access points) and more centralized points of presence. See **Cellular Backhaul**. |
| **Balanced** | A transmission line in which voltages on the two conductors are equal in magnitude, but opposite in polarity, with respect to ground. |
| **Bandwidth** | The range of frequencies passing through a given circuit. The greater the bandwidth, the more information can be sent through the circuit in a given amount of time. |
| **Baud** | Unit of signaling speed equivalent to the number of discrete conditions or events per second. If each signal event represents only one bit condition, baud rate equals bps (bits per second). |
| **Bit** | The smallest unit of information in a binary system. Represents either a one or zero (“1” or “0”). |
| **bps (Bits Per Second)** | A measure of data transmission rate in serial transmission. |
| **Bridge** | A device interconnecting local area networks at the OSI data link layer, filtering and forwarding frames according to media access control (MAC) addresses. |
| **Buffer** | A storage device. Commonly used to compensate for differences in data rates or event timing when transmitting from one device to another. Also used to remove jitter. |
| **Bus** | A transmission path or channel. A bus is typically an electrical connection with one or more conductors, where all attached devices receive all transmissions at the same time. |
| **Byte** | A group of bits (normally 8 bits in length). |
| **Carrier** | A continuous signal at a fixed frequency that is capable of being modulated with a second (information carrying) signal. |

| | |
|---|---|
| Cell | The 53-byte basic information unit within an ATM network. The user traffic is segmented into cells at the source and reassembled at the destination. An ATM cell consists of a 5-byte ATM header and a 48-byte ATM payload, which contains the user data. |
| Channel | A path for electrical transmission between two or more points. Also called a link, line, circuit or facility. |
| Clock | A term for the source(s) of timing signals used in synchronous transmission. |
| Compression | Any of several techniques that reduce the number of bits required to represent information in data transmission or storage, thereby conserving bandwidth and/or memory. |
| Congestion | A state in which the network is overloaded and starts to discard user data (frames, cells or packets). |
| Data | Information represented in digital form, including voice, text, facsimile and video. |
| Data Link Layer | Layer 2 of the OSI model. The entity, which establishes, maintains, and releases data-link connections between elements in a network. Layer 2 is concerned with the transmission of units of information, or frames, and associated error checking. |
| Diagnostics | The detection and isolation of a malfunction or mistake in a communications device, network or system. |
| Digital | The binary ("1" or "0") output of a computer or terminal. In data communications, an alternating, non-continuous (pulsating) signal. |
| E1 Line | A 2.048 Mbps line, common in Europe, that supports thirty-two 64 kbps channels, each of which can transmit and receive data or digitized voice. The line uses framing and signaling to achieve synchronous and reliable transmission. The most common configurations for E1 lines are E1 PRI, and unchannelized E1. |
| E3 | The European standard for high speed digital transmission, operating at 34 Mbps. |
| Encapsulation | Encapsulating data is a technique used by layered protocols in which a low level protocol accepts a message from a higher level protocol, then places it in the data portion of the lower-level frame. The logistics of encapsulation require that packets traveling over a physical network contain a sequence of headers. |
| Equalizer | A device that compensates for distortion due to signal attenuation and propagation time with respect to frequency. It reduces the effects of amplitude, frequency and/or phase distortion. |
| Ethernet | A local area network (LAN) technology which has extended into the wide area networks. Ethernet operates at many speeds, including data rates of 10 Mbps (Ethernet), 100 Mbps (Fast Ethernet), 1,000 Mbps (Gigabit Ethernet), 10 Gbps, 40 Gbps, and 100 Gbps. |

| | |
|---|---|
| Ethernet OAM | Ethernet operation, administration and maintenance (OAM) are a set of standardized protocols for measuring and controlling network performance. There are two layers of Ethernet OAM: Service OAM (provides end-to-end connectivity fault management per customer service instance, even in multi-operator networks) and Link or Segment OAM (detailed monitoring and troubleshooting of an individual physical or emulated link). |
| Flow Control | A congestion control mechanism that results in an ATM system implementing flow control. |
| Frame | A logical grouping of information sent as a link-layer unit over a transmission medium. The terms packet, datagram, segment, and message are also used to describe logical information groupings. |
| Framing | At the physical and data link layers of the OSI model, bits are fit into units called frames. Frames contain source and destination information, flags to designate the start and end of the frame, plus information about the integrity of the frame. All other information, such as network protocols and the actual payload of data, is encapsulated in a packet, which is encapsulated in the frame. |
| Full Duplex | A circuit or device permitting transmission in two directions (sending and receiving) at the same time. |
| FXO (Foreign Exchange Office) | A voice interface, emulating a PBX extension, as it appears to the CO (Central Office) for connecting a PBX extension to a multiplexer. |
| FXS (Foreign Exchange Subscriber) | A voice interface, emulating the extension interface of a PBX (or subscriber interface of a CO) for connecting a regular telephone set to a multiplexer. |
| G.703 | An ITU standard for the physical and electrical characteristics of various digital interfaces, including those at 64 kbps and 2.048 Mbps. |
| Gateway | Gateways are points of entrance and exit from a communications network. Viewed as a physical entity, a gateway is that node that translates between two otherwise incompatible networks or network segments. Gateways perform code and protocol conversion to facilitate traffic between data highways of differing architecture. |
| Half Duplex | A circuit or device capable of transmitting in two directions, but not at the same time. |
| Interface | A shared boundary, defined by common physical interconnection characteristics, signal characteristics, and meanings of exchanged signals. |
| IP Address | Also known as an Internet address. A unique string of numbers that identifies a computer or device on a TCP/IP network. The format of an IP address is a 32-bit numeric address written as four numbers from 0 to 255, separated by periods (for example, 1.0.255.123). |

| | |
|---|---|
| **Jitter** | The deviation of a transmission signal in time or phase. It can introduce errors and loss of synchronization in high speed synchronous communications. |
| **Laser** | A device that transmits an extremely narrow and coherent beam of electromagnetic energy in the visible light spectrum. Used as a light source for fiber optic transmission (generally more expensive, shorter lived, single mode only, for greater distances than LED). |
| **Loop Start** | The most commonly used method of signaling an off-hook condition between an analog phone set and a switch, where picking up the receiver closes a wire loop, allowing DC current to flow, which is detected by a PBX or local exchange and interpreted as a request for service. |
| **Loopback** | A type of diagnostic test in which the transmitted signal is returned to the sending device after passing through all or part of a communications link or network. |
| **Manager** | An application that receives Simple Network Management Protocol (SNMP) information from an agent. An agent and manager share a database of information, called the Management Information Base (MIB). An agent can use a message called a traps-PDU to send unsolicited information to the manager. A manager that uses the RADview MIB can query the RAD device, set parameters, sound alarms when certain conditions appear, and perform other administrative tasks. |
| **Master Clock** | The source of timing signals (or the signals themselves) that all network stations use for synchronization. |
| **Multiplexer** | At one end of a communications link, a device that combines several lower speed transmission channels into a single high speed channel. A multiplexer at the other end reverses the process. Sometimes called a mux. See **Bit Interleaving/Multiplexing**. |
| **Network** | (1) An interconnected group of nodes. (2) A series of points, nodes, or stations connected by communications channels; the collection of equipment through which connections are made between data stations. |
| **Node** | A point of interconnection to a network. |
| **Off-Hook** | A state that results when you lift a telephone receiver, producing a busy signal. |
| **Packet** | An ordered group of data and control signals transmitted through a network, as a subset of a larger message. |
| **Payload** | The 48-byte segment of the ATM cell containing user data. Any adaptation of user data via the AAL will take place within the payload. |
| **Physical Layer** | Layer 1 of the OSI model. The layer concerned with electrical, mechanical, and handshaking procedures over the interface connecting a device to the transmission medium. |

| | |
|---|---|
| **Polling** | See **Multidrop**. |
| **Port** | The physical interface to a computer or multiplexer, for connection of terminals and modems. |
| **Protocol** | A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems. |
| **Serial Transmission** | A common mode of transmission, where the character bits are sent sequentially one at a time instead of in parallel. |
| **Single Mode** | Describing an optical wave-guide or fiber that is designed to propagate light of only a single wavelength (typically 5-10 microns in diameter). |
| **Space** | In telecommunications, the absence of a signal. Equivalent to a binary 0. |
| **Sync** | See **Synchronous Transmission**. |
| **Synchronous Transmission** | Transmission in which data bits are sent at a fixed rate, with the transmitter and receiver synchronized. |
| **T1** | A digital transmission link with a capacity of 1.544 Mbps used in North America. Typically channelized into 24 DS0s, each capable of carrying a single voice conversation or data stream. Uses two pairs of twisted pair wires. |
| **T3** | A digital transmission link with a capacity of 45 Mbps, or 28 T1 lines. |
| **Telnet** | The virtual terminal protocol in the Internet suite of protocols. It lets users on one host access another host and work as terminal users of that remote host. Instead of dialing into the computer, the user connects to it over the Internet using Telnet. When issuing a Telnet session, it connects to the Telnet host and logs in. The connection enables the user to work with the remote machine as though a terminal was connected to it. |
| **VLAN-Aware** | A device that is doing the Layer 2 bridging according to the VLAN tag in addition to the standard bridging parameters. A VLAN-aware device will not strip or add any VLAN header. |
| **VLAN Stacking** | A technique that lets carriers offer multiple virtual LANs over a single circuit. In essence, the carrier creates an Ethernet virtual private network to tunnel customer VLANs across its WAN; this helps avoid name conflicts among customers of service providers who connect to the carrier. Stacking works by assigning two VLAN IDs to each frame header. One is a "backbone" VLAN ID used by the service provider; the other one has up to 4,096 unique 802.1Q VLAN tags. |

# Quick Start Guide

Your unit should only be installed by an experienced technician. If you are familiar with RICi-4E1/T1, RICi-8E1/T1, use this guide to prepare the units for operation.

## 1. Installing RICi-4E1/T1, RICi-8E1/T1

### Connecting the Interfaces

1. Connect the network to the RJ-45 connector designated **E1** or **T1**.
   - In case of fiber optical interfaces, first insert the SFP and then connect the Ethernet equipment using a standard fiber optic cable terminated with an LC connector.
2. Connect the user LAN to the RJ-45 connector designated **10/100 BaseT**.
3. Connect a terminal to the front panel CONTROL connector

   OR

   Connect a Telnet host, a PC running a Web browsing application, or an SNMP management station to the Ethernet port assigned to management.

### Connecting the Power

- Connect the power cable to the power connector on the rear panel.

  The unit has no power switch. It starts operating when the power connector at the rear is connected to the mains.

# 2. Configuring RICi-4E1/T1, RICi-8E1/T1

Configure RICi-4E1/T1, RICi-8E1/T1 to the desired operation mode via an ASCII terminal connected to the front panel CONTROL port. After configuring, you can manage the unit over Telnet, a PC running a Web browsing application, or SNMP via either the Ethernet or E1 port.

***Note*** *Remote management requires assigning an IP address.*

## Starting a Terminal Session for the First Time

For first use, you have to use an ASCII terminal to configure RICi-4E1/T1, RICi-8E1/T1.

➤ **To start a terminal session:**

1. If not already done, connect a terminal to the CONTROL connector.
2. Turn on the control terminal PC and set its default port parameters to a baud rate of 115,200 bps, 8 data, 1 stop bit and no parity.
3. Set the terminal emulator to ANSI VT100 emulation (to ensure an optimal view of system menus).
4. Set the terminal screen width to 132 characters.
5. Enter your user name and password and proceed with the management session.

***Note*** *The default user name is **su**, and the default password is **1234**.*

## Configuring the IP Management Parameters

You have to configure the IP address, the subnet mask, and the default gateway.

➤ **To configure IP management parameters:**

- Navigate to the Host IP menu (Main › Configuration › System › Management › **Host IP**) and configure the required IP host parameters.

## Configuring Ports at the Physical Level

You have to first configure the ports at the physical level.

➤ **To configure the Fast Ethernet ports:**

1. From the Physical Ports menu (Main › Configuration › **Physical Ports**), go to **Activation** and activate or deactivate the ports as needed.
2. Disable or enable Auto Negotiation, Flow Control and MDIX Auto Cross Over as needed.

➤ **To configure E1/T1 ports:**

1. From the Physical Port menu (Main › Configuration › **Physical Port**), choose the port type.
2. Under **Activation**, activate or deactivate the port as needed.
3. Configure the required parameters associated with the relevant port.

## Configuring the Bridge

The bridge parameters, as well as the bridge ports and the VLAN memberships, must be configured according to your application requirements.

➤ **To configure the bridge:**

- From the Bridge menu (Main › Configuration › Applications › Bridge), configure the VLAN and filtering modes of the RICi-4E1/T1, RICi-8E1/T1 bridges.

➤ **To configure the bridge ports:**

- From the Bridge Port menu (Configuration› Applications › Bridge › Bridge Port), select a bridge port and configure the necessary parameters.

➤ **To configure the VLAN memberships:**

- From the VLAN Membership menu (Configuration › Applications › Bridge › VLAN Membership), create a new VLAN and define the egress tagged and untagged ports which are the VLAN members.

## Configuring the QoS

In order to prioritize the traffic, you have to choose a priority classification method and assign priorities to the traffic queues according to the selected method.

➤ **To select a priority classification method:**

- From the QoS menu (Main › Configuration › Applications › **QoS**), select **Priority Classification** and choose the desired traffic classification method: 802.1p, DSCP or Per Port.

➤ **To assign priorities to the traffic queues:**

- From the Priority Mapping menu (Main › Configuration › Applications › **QoS**), select **Priority Mapping** and assign priorities to the traffic queues according to the selected method.

# Contents


Chapter 1. Introduction

1.1 Overview....1-1
Product Options....1-1
Applications....1-2
Features....1-2
1.2 Physical Description....1-6
1.3 Functional Description....1-7
Bridge....1-7
Quality of Service....1-14
Management....1-15
1.4 Technical Specifications....1-16
General....1-16
Interfaces....1-17

Chapter 2. Installation and Setup

2.1 Introduction....2-1
2.2 Site Requirements and Prerequisites....2-1
2.3 Package Contents....2-2
2.4 Required Equipment....2-2
2.5 Mounting the Unit....2-3
2.6 Installing Fiber Optic SFP Modules....2-3
2.7 Connecting to Ethernet Equipment....2-4
2.8 Connecting to E1/T1 Equipment....2-5
2.9 Connecting to Management Stations....2-6
Connecting to an ASCII Terminal....2-6
2.10 Connecting to Power....2-7
Connecting AC Power....2-7
Connecting DC Power....2-7

Chapter 3. Operation

3.1 Turning On the Unit....3-1
3.2 Indicators....3-2
3.3 Default Settings....3-4
3.4 Configuration and Management Alternatives....3-8
Working with an ASCII Terminal....3-8
Working with Web Terminal....3-10
Working with RADview-Lite....3-12
Menu Map....3-13
3.5 Turning Off the Unit....3-14

Chapter 4. Configuration

4.1 Configuring for Management....4-1
Defining Host IP Parameters....4-2
Entering Device Information....4-4
Controlling Management Access....4-4
Configuring User Access....4-5
Configuring Network Managers....4-6

Configuring Radius Client ..... 4-7
Defining the Access Policy ..... 4-9
Configuring Control Port Parameters ..... 4-10
4.2 Configuring for Operation ..... 4-10
Setting Device-Level Parameters ..... 4-10
Setting Physical Layer Parameters ..... 4-12
Setting Logical Layer Parameters ..... 4-17
Setting Application-Level Parameters ..... 4-18
4.3 Additional Tasks ..... 4-34
Configuring Date and Time ..... 4-34
Configuring the Syslog Parameters ..... 4-35
Viewing Inventory ..... 4-37
Transferring Software and Configuration Files ..... 4-38
Resetting RICi-4E1/T1, RICi-8E1/T1 ..... 4-39

Chapter 5. Configuring a Typical Application

5.1 Application Requirements ..... 5-1
5.2 Configuring the Management Parameters ..... 5-2
Defining the Host ..... 5-2
Defining the Default Gateway ..... 5-2
Defining Managers ..... 5-3
5.3 Configuring E1/T1 Physical Layer ..... 5-4
5.4 Configuring the Bridge ..... 5-4
Defining the Bridge ..... 5-4
Defining Bridge Ports ..... 5-5
Defining VLAN Memberships ..... 5-5

Chapter 6. Troubleshooting and Diagnostics

6.1 Monitoring Performance ..... 6-1
Viewing System Status Information ..... 6-1
Viewing Physical Layer Status ..... 6-2
Viewing Application-Level Status ..... 6-3
Viewing Interface Statistics ..... 6-4
6.2 Handling Alarms and Traps ..... 6-6
Displaying Events ..... 6-6
Clearing Events ..... 6-7
Traps Generated by RICi-4E1/T1, RICi-8E1/T1 ..... 6-8
6.3 Troubleshooting ..... 6-9
6.4 Testing the Unit ..... 6-10
Running a Ping Test ..... 6-10
Tracing the Route ..... 6-10
Performing a Loopback Test on E1/T1 Links ..... 6-11
Performing Bit Error Rate Test (BERT) ..... 6-12
Running OAM Tests ..... 6-13
6.5 Technical Support ..... 6-20

Appendix A. Connector Wiring

Appendix B. Boot Sequence and Downloading Software

# Chapter 1
# Introduction

## 1.1 Overview

RICi-4E1/T1, RICi-8E1/T1 is a Network Termination Unit (NTU) connecting Fast Ethernet LANs over four or eight E1 or T1 circuits. RICi-4E1/T1, RICi-8E1/T1 is part of RAD's RICi product family. It enables service provisioning and backhaul applications over low- and high-speed SDH/SONET and PDH circuits, from fractional and full E1/T1 and E3/T3 over STM-1/OC-3 and STM-4/OC-12 to Ethernet networks.

RICi-4E1/T1, RICi-8E1/T1 can bond four or eight E1 or T1 ports together using Multilink PPP (MLPPP), creating a large virtual pipe.

RICi-4E1/T1, RICi-8E1/T1 provides Layer-2 switching (bridge) between the Ethernet ports and the E1/T1 port, including VLAN-unaware and VLAN-aware bridging modes supporting VLAN based Layer-2 VPNs.

Depending on the hardware configuration, RICi-4E1/T1, RICi-8E1/T1 provides 4 x 10/100BaseT or 2 x 10/100BaseT and 2 x SFP-based 100BaseFx Fast Ethernet ports. In the 4 x 10/100BaseT configuration, you may use one Ethernet port for out-of-band management. In addition, RICi-4E1/T1, RICi-8E1/T1 collects data that allows monitoring the performance and troubleshooting.

Serial data in RICi-4E1/T1 passes via the E1/T1 port and has priority over the LAN traffic.

RICi-4E1/T1, RICi-8E1/T1 supports Telnet, Web terminal, and SNMP for inband configuration and management, as well as an ASCII terminal for out-of-band management.

RICi-4E1/T1, RICi-8E1/T1 ships as a compact standalone enclosure (1U, 8.5" wide), with an optional 19" rack mounting kit.

## Product Options

### Uplink Options

The following uplink options are available:

- **RICi-4E1 and RICi-4T1**: Four E1/T1 ports
- **RICi-8E1 and RICi-8T1**: Eight E1/T1 ports.

The E1 ports can be balanced or unbalanced.

### Ethernet Port Options

RICi-4E1/T1, RICi-8E1/T1 has four Fast Ethernet interfaces, available in one of the following configurations:

- 4 x 10/100BaseT copper ports. The fourth port can be dedicated for out-of-band management.
- 2 x 10/100BaseT copper ports plus 2 x SFP-based 100BaseFx optical ports.

## Applications

Typical applications include Ethernet VPN services over E1/T1 links, and aggregation of enterprise LANs over E1/T1.

*Figure 1-1* illustrates a typical application, where a unit connects users in remote LANs to the packet network over E1/T1 with an SDH/SONET connection.

*Figure 1-1. Typical Application*

## Features

### Ethernet Interfaces

The Fast Ethernet interfaces operate in full or half (10/100BaseT only) duplex, with flow control (pause frames). Ethernet and 802.3 standards are supported.

Copper Ethernet physical interfaces are electrical 10/100BaseT and support autonegotiation.

Optical Ethernet physical interfaces are SFP-based 100BaseFx.

In 4 x 10/100BaseT configurations, you can dedicate the fourth port to out-of-band local management.

The Ethernet ports can be configured to accept traffic only from the first MAC address(es) from which they receive traffic. You can configure how many MAC addresses should be protected in this way, for each Ethernet port.

### WAN Interfaces

RICi-4E1/T1, RICi-8E1/T1 supports four or eight unframed E1 or eight framed T1 interfaces.

The E1 ports support a data rate of 2.048 Mbps, unframed, and are G.703 compliant.

The T1 ports support a data rate of 1.544 Mbps, with D4 or ESF framing. The ports are compliant with AT&T TR62411 and ANSI T1.403 standards.

### MLPPP

The unit bonds four or eight E1/T1 ports utilizing the Multilink Point-to-Point Protocol (MLPPP), bridging the bandwidth gap between E1/T1 and E3/T3, and creating a large virtual pipe.

## Bridge

RICi-4E1/T1, RICi-8E1/T1 provides a bridging mechanism between the following bridge ports:

- Fast Ethernet ports
- MLPPP bundle over E1/T1 ports (Ethernet over E1/T1)
- Internal host.

The internal bridge operates in VLAN-unaware or VLAN-aware modes.

The VLAN-aware bridge mode allows the user to create a subgroup of bridge ports within the bridge. Each such subgroup is associated with a unique VID. Frames can be forwarded only between bridge ports that are members of the same VLAN, thus enabling a total separation between different VLAN users within the same bridge.

In the VLAN-unaware Bridge mode the bridge ignores VLAN tags and forwards frames only according to the MAC addresses of their sources and destinations.

Ethernet Type (TPID) is configurable per bridge port, therefore the RICi-4E1/T1, RICi-8E1/T1 unit can be used in networks utilizing Ethertypes other than the 802.1q Ethertype 0x8100.

RICi-4E1/T1, RICi-8E1/T1 supports QoS mapping from Ethernet ports, Ethernet VLAN priority (802.1p), or DSCP to egress queue priority at E1/T1 level.

## Ethernet OAM

RICi-4E1/T1, RICi-8E1/T1 provides Ethernet end-to-end OAM based on 802.1ag and Y.1731 to enable Ethernet service providers to monitor their services proactively, measure end-to-end performance, and guarantee that the customers receive the contracted SLA. Fault monitoring and performance measurement include Frame Delay, Frame Delay Variation, Frame Loss, and Frame Availability.

## Management

Setup, control, and monitoring of status and diagnostics can be performed using the following methods:

- Inband or out-of-band management:
  - **Inband.** Local and remote management via an Ethernet or E1/T1 port.
  - **Out-of-band.** Management via a local ASCII terminal connected to the V.24 (RS-232) DCE control port. In devices with four electrical 10/100BaseT ports, the fourth Ethernet port can be configured as an out-of-band management port.
  - The device can be managed via Telnet, Web browser, or SNMP (RADview-Lite).
- **Web terminal.** This tool is a user-friendly Web-based element management system for remote device configuration and maintenance. It is embedded in the units and is provided at no extra cost. The Web terminal application can be run from any standard Web browser.

- **RADview-Lite.** RAD's SNMP-based element management software, providing SNMP traps, status polling, and configuration download. Remote element management is available in RADview-Lite via Web-based application.

The following functionalities are available with the internal management software:

- Viewing system information
- Modifying configuration and mode of operation, including setting system default values and resetting the unit
- Monitoring performance
- Initiating connectivity tests
- Ping and Trace Route
- Remote software and configuration download/upload (TFTP)
- Upgrading software.

### *Security*

The management applications are password protected.

RICi-4E1/T1, RICi-8E1/T1 supports the following access authorization levels:

- Super-user mode for configuration and monitoring
- User mode for monitoring and configuration view only.

***Note*** *You must re-enter the user name and the password if five minutes have elapsed without entering at least one character.*

The units support the following security protocols, providing a high level of client server communication security.

- RADIUS authentication
- SSL for Web based management application
- SSH for Secure Shell communication session

### *Remote Monitoring with Syslog*

RICi-4E1/T1, RICi-8E1/T1 uses the Syslog protocol to generate and transport event notification messages over IP networks to up to five central Syslog servers. The Syslog operation is compliant with RFC 3164.

## Timing

RICi-4E1/T1, RICi-8E1/T1 has a single clock domain with master and fallback sources for timing. The clock source can be the internal oscillator or loopback timing (LBT) from an E1/T1 link.

## Diagnostics

RICi-4E1/T1, RICi-8E1/T1 offers several types of diagnostic and troubleshooting procedures:

- Remote loopbacks on the E1/T1 ports, towards line
- Ping tests
- Trace Route
- Bit Error Rate Test (BERT) on the E1/T1 ports
- Events/Traps – Traps can be masked, per manager IP address, upon user configuration.

## Statistics

RICi-4E1/T1, RICi-8E1/T1 provides statistics and counter capabilities at the physical Ethernet and MLPPP level (logical layer), and frame statistics at the E1/T1 level.

## Event Log File

The event log file includes entries at the system, Ethernet, and E1/T1 levels. The events are stored and time-stamped in an event log file. Up to 1000 cyclic entries are maintained.

The NTP client is integrated in RICi-4E1/T1, RICi-8E1/T1. If an NTP server is available, log file events are marked with the time and the date received from it. If no NTP server is available, log files are marked with the elapsed time since the system was started.

## Temperature-Hardened Version

A temperature-hardened version is available, significantly extending the permitted operating temperature range.

## Compact Size

RICi-4E1/T1, RICi-8E1/T1 is compact, 1U high and half the width of a standard 19″ rack. It can be mounted in a rack or used as a standalone unit.

## 1.2 Physical Description

RICi-4E1/T1, RICi-8E1/T1 is a 1U standalone or rack mountable unit. *Figure 1-2* illustrates a three-dimensional view of RICi-4E1 and RICi-8E1 with Ethernet and E1 interfaces. The remaining versions within this range are similar with respect to corresponding numbers of E1 or T1 interfaces. Front panels are illustrated in *Chapter 3*.

*Figure 1-2. 3-D View*

LEDs, interface, and control connectors are located on the front panel. For additional information, refer to *Chapter 2*. The power connector is located on the rear panel.

## 1.3 Functional Description

This section lists and explains the key features of RICi-4E1/T1, RICi-8E1/T1.

### Bridge

RICi-4E1/T1, RICi-8E1/T1 has multi-port bridging capability with up to six bridge ports. The bridge supports two modes of operation, VLAN-aware and VLAN-unaware.

The mechanism of each mode can be described as five different processes:

- **Ingress.** Checks each frame entering the bridge to decide if and how this frame should be passed on to the forwarding process.
- **Learning.** Applies to MAC only or MAC VID pairs and learns new MAC table entries.
- **Aging.** Checks the forwarding MAC table periodically.
- **Forwarding.** Decides to which bridge port/ports to forward the frame.
- **Transmission.** Applies to the VLAN-aware mode only and selects the format of the transmitted frame at the output port: with VLAN ID (tagged) or without VLAN ID (untagged).

Bridge features and these five processes are described below for each mode.

## VLAN-Aware Mode

This mode enables creation of sub-groups of bridge ports within the bridge. Each sub-group is defined per VLAN and is associated with a unique VLAN ID (VID). Frames containing a VID can be forwarded only between bridge ports that are members of this specific VLAN, thus enabling a total separation between different VLAN users within the same bridge.

In addition, each bridge port is associated with Ethernet Type (TPID). The default is 0x8100 (801.1Q Ether Type), but any number may be configured, thus enhancing the bridge capability to cope with provider networks that utilize other Ether Types (e.g. 0x9100).

### *Bridge Features*

- Full VLAN-aware bridge, complying with 802.1Q
- Learning and forwarding according to MAC address and VID
- Learning of up to 2,048 MAC table entries (MAC + VID pairs)
- Configuration of the aging time
- MAC table viewing (learned MACs).

### *Ingress Process*

The ingress process is composed of three steps: frame admission, ingress filtering and PVID assignment to untagged/priority-only tagged frames.

- **Frame admission.** Two modes of operation, configured per bridge:
  - **Admit all frames**. All frames arriving from the port are admitted and proceed to the ingress filtering process. PVID is assigned to untagged or priority only tagged frames.
  - **Admit only VLAN tagged frames.** Only VLAN tagged frames are admitted and allowed to proceed to the ingress filtering process. Untagged or priority-only tagged frames are discarded.
- **Ingress filtering.** One of the following modes, configured per bridge port:
  - **Enable**. Perform ingress filtering according to VID. This means that only frames that share a VID assigned to this bridge port are admitted.
  - **Disable**. All frames are forwarded.

    Only admitted frames that pass filtering are submitted to learning and forwarding processes.
- **PVID assignment.** Per bridge port configuration.

  In VLAN-aware mode, each received frame entering the bridge is associated with a single VID. If the received frame does not contain a VLAN ID (untagged or priority only tagged frames), a specific PVID is assigned to these frames before they pass to the forwarding process.

  This means that the untagged/priority tagged frames that have passed the admission/ingress filtering are tagged with PVID and proceed to the forwarding process. Tagged frames will be double-tagged with the PVID only if Tag Stacking is enabled.

  For untagged frames that were tagged during this process to VID=PVID, the priority tag is assigned at the VLAN priority field, according to the default priority configuration.

  *Table 1-1* summarizes the behavior of the ingress process.

*Table 1-1. Ingress process*

| Frame Admission Mode | Ingress Filtering Mode | Bridge Behavior |
|---|---|---|
| Admit all frames | Enable | VLAN tagged frames with a VID (or PVID for untagged/priority tagged frames) that do not include the bridge port in their VLAN member set – are dropped. |
| | Disable | All frames pass. |
| Admit VLAN tagged frames | Enable | VLAN tagged frames with a VID that do not include the bridge port in their member set – are dropped. Untagged/priority-only tagged frames are dropped. |
| | Disable | All VLAN tagged frames pass. Untagged/priority-only tagged frames are dropped. |

Frames that pass this stage are submitted to the forwarding process and to the learning process.

### *Learning Process*

The learning process observes the source MAC address (SA) and the VID of the received frame, and updates the forwarding database with the MAC VID pair and with the bridge port that the frame was received from. The Forwarding Data Base (FDB) is also referred to as a MAC table.

Entries in the MAC table can be dynamic (inserted by the learning process) or static (inserted by configuration). A dynamic entry has an aging time associated with it.

The VLAN-aware bridge is an Independent VLAN Learning (IVL) bridge.

The learning process inserts a new dynamic entry to the MAC table. This entry consists of a MAC-VID pair and bridge port.

- If the MAC-VID pair already exists for the same port, the aging time is updated.
- If the MAC-VID pair already exists but for a different bridge port (dynamic entry) the new entry overrides the existing one.
- If the MAC-VID pair already exists for a different bridge port (static entry) the static entry prevails.

### *Aging Process*

The aging process checks the forwarding MAC table periodically. Each dynamic entry-aging period that has exceeded the configured aging time limit is deleted. The aging period is the time since the last frame for this entry has entered the bridge. The periodic check of the MAC table (aging time intervals) results in actual aging time that can reach up to twice the value that was configured by the user.

### *Forwarding Process*

The forwarding process is performed based on the frame destination MAC VID pair. The frame is forwarded to the bridge port specified in the MAC table for this MAC VID pair entry.

Untagged frames are forwarded according to the PVID attached to that frame during the ingress process.

Frames are forwarded, dropped or flooded as follows:

- Forwarded:
  - If the bridge port of the pair entry (DA, VID) in the MAC table is both an active bridge port and a member of the VLAN – the frame is forwarded to that bridge port only.
- Dropped:
  - If the bridge port for the pair entry (DA, VID) in the MAC table is the port on which the frame was received, the frame is dropped.
  - If there are no active ports associated with the frame's VID, or if the VID is not defined at all, the frame is dropped.
- Flooded:
  - If the pair (DA, VID) has not been learnt and does not exist in the MAC table, the frame is transmitted to all bridge ports associated with the frame's VLAN ID.
  - Multicasts and broadcasts are flooded only via the bridge ports whose VLAN IDs are identical to the frame's VLAN ID.

### *Transmission Process*

After the forwarding process identifies the destination bridge port/ports to which the frame should be transmitted, the transmission process transmits it with the appropriate format. For each VLAN and each port, the user can configure the frame format to be used:

- VLAN-tagged. Frames are transmitted as follows:
  - VLAN-tagged frames are transmitted unchanged.
  - Untagged frames are transmitted tagged with priority according to the default priority of the ingress bridge port, and VID=PVID of the port from which they have entered.
  - Priority-tagged frames are transmitted tagged with original priority and VID = PVID.
- Untagged. All frames are transmitted untagged.

## VLAN-Unaware Mode

In this mode the bridge forwarding ignores the VLAN ID of VLAN tagged frames.

Each Ethernet packet received from each bridge port (Ethernet or E1s) is forwarded according to its destination MAC address.

### *Bridge Features*

- Learning and forwarding according to MAC address only
- Learning of up to 2048 MAC addresses
- Configuration of the aging time
- VLAN tagged frames transparency (forwarding according to MAC only)
- MAC table viewing (learned MACs).

### *Ingress Process*

All frames are accepted in this mode: untagged, priority-tagged or VLAN-tagged.

Learning and forwarding is based on the MAC addresses, with no regard to the VLAN. This mode is sometimes regarded to as transparent mode, due to "tag transparency".

### *Learning Process*

The learning process observes the source MAC address (SA) of the received frame and updates the forwarding database (FDB) with the MAC and the bridge port that the frame was received from. FDB is also referred to as MAC table.

The learning process inserts a new entry into the MAC table. This entry consists of the MAC and the bridge port.

- If the MAC already exists for the same bridge port, the aging time will be updated.
- If the MAC already exists, but for a different bridge port, (dynamic entry) the new entry will override the existing one.

### *Aging Process*

The aging process checks the forwarding MAC table periodically. Each dynamic entry aging time period that has exceeded the configured Aging Time Limit is deleted. The aging time period is the period of time since the last frame for this entry has entered the bridge. The periodic check of the MAC table (aging time intervals), results in an actual aging time that can reach up to twice the value that was configured by the user.

### *Forwarding Process*

The forwarding process is performed based on the frame MAC Destination Address (MDA). The frame is forwarded to the Bridge/port specified in the MAC table for this MAC.

Frames are forwarded, dropped or flooded at this stage for the following reason:

- Forwarded: A frame will be forwarded according to its DA, to the bridge port where its DA was learned.
- Dropped: If the port for that DA entry in the MAC table is the port on which the frame was received, the frame will be dropped.
- Flooded:
  - If there is no information regarding the DA in the MAC table, the frame is flooded to all ports.
  - Frames with multicast or broadcast address are flooded to all ports.

### *Transmission Process*

In this bridge mode (VLAN-unaware), the frames are transmitted unchanged: No tags are added or removed.

## VLAN Stacking

VLAN stacking mode for a bridge port refers to the addition of a tag to an incoming frame either at ingress or egress (regardless of whether it already has an existing VLAN tag), and removal of a tag at ingress or egress when the frame leaves from this port.

This setting is independent of the bridge activity.

## Quality of Service

RICi-4E1/T1, RICi-8E1/T1 support QoS mapping to priority queues (3 PQ, strict priority, per bridge port) at the E1/T1 egress according to one of the following:

- VLAN priority (802.1p)
- DSCP (ToS byte)
- Port-based

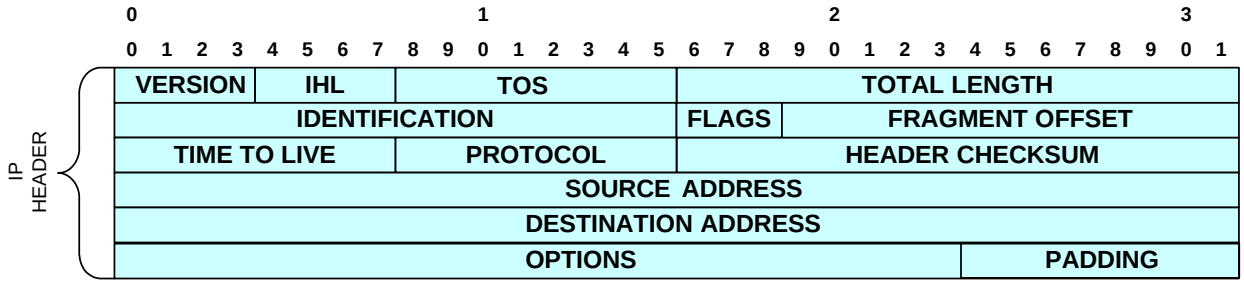



*Figure 1-3. IP Header*

| Bit 0 | Bit 1 | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 |
|---|---|---|---|---|---|---|---|
| DS5 | DS4 | DS3 | DS2 | DS1 | DS0 | XX | XX |

DSCP: six bits (DS5–DS0)

*Figure 1-4. ToS Byte DSCP Field*

## Management

The performance of RICi-4E1/T1, RICi-8E1/T1 can be locally monitored from an ASCII terminal, or from a remote site using Telnet, SNMP, Web terminal or RADview-Lite.

### Inband Management

RICi-4E1/T1, RICi-8E1/T1 enable configuring, monitoring and following up on statistics via Telnet, SNMP and the Web.

### Out-of-Band Management

RICi-4E1/T1, RICi-8E1/T1 allows full configuration and diagnostics via an ASCII terminal. The ASCII terminal is connected to the control port on the front panel.

*Chapter 3* explains how to activate the ASCII terminal and provides general instructions on navigating to various system menus and windows and modifying data.

Units with 4 x 10/100BaseT configurations enable managing the respective unit via a dedicated Fast Ethernet port using a Telnet server, SNMP V1, or Web based tools such as Web terminal and RADview-Lite. Refer to *Chapter 3* for additional information.

### Management Access

The architecture allows access from every bridge port to both the host and the remote site devices. Depending on the configuration mode, you may dedicate a port to management traffic, thus separating management and user traffic.

In this scenario, traffic coming from the remote CPE uses two VLANs, one for user traffic, for which the CPE may use tag stacking, and the other one for management traffic. All CPEs connected to RICi-4E1/T1, RICi-8E1/T1 share the same management VLAN.

In VLAN-aware mode, RICi-4E1/T1, RICi-8E1/T1 forwards the management traffic to the Ethernet cloud network management station. Using a different VLAN maintains strict separation of user and management traffic.

## 1.4 Technical Specifications

This section lists the technical specifications of RICi-4E1/T1, RICi-8E1/T1.

### General

| | | |
|---|---|---|
| **Internal Bridge** | *Ports* | • Fast Ethernet (up to four)<br>• Local host (one)<br>• MLPPP (one port combining up to eight E1/T1 lines) |
| | *LAN Table* | Up to 2,048 MAC addresses of which 30 are static |
| | *Operation Mode* | VLAN-aware, VLAN-unaware |
| | *Filtering and forwarding* | Transparent or Filter |
| **Control Port** | *Interface* | RS-232/V.24 (DTE asynchronous) |
| | *Data Rate* | 9.6, 19.2, 115.2 kbps |
| | *Connector* | DB-9, female |
| **Monitoring** | *Statistics* | System and physical layer Alarms<br>ETH or E1 frame counters<br>Ethernet physical layer statistics and frame counters |
| **Indicators** | *PWR (green)* | **On**: The unit is running<br>**Off**: The unit is off |
| | *TST (green)* | **On**: Self test succeeded<br>**Off**: Self test or diagnostics underway |
| | *ALM (red)* | **On**: Interface alarm<br>**Off**: No alarm |
| | *LINK (green) for each Ethernet port* | **On**: Ethernet link is active<br>**Off**: Ethernet link is inactive |
| | *ACT (yellow) for each Ethernet port* | **Blinking**: Ethernet frame received or sent within the last second<br>**Off**: No frame received or sent within the last second |

| | | |
|---|---|---|
| | *LOC (red) for each port (E1 only)* | **On**: Local sync loss<br>**Off**: No loss |
| | *REM (red) for each port (E1 only)* | **On**: Remote sync loss<br>**Off**: No loss |
| | *RED (red) for each port (T1 only)* | **On**: Local sync loss<br>**Off**: No loss |
| | *YEL (yellow) for each port (T1 only)* | **On**: Remote sync loss<br>**Off**: No loss |
| **Power** | *AC Source* | 100–240 VAC, 50/60 Hz |
| | *DC Source* | 48/60 VDC nominal (40–72 VDC) |
| | *Power Consumption* | 9W |
| **Physical** | *Height* | 43.7 mm (1.7 in) (1U) |
| | *Width* | 215.0 mm (8.5 in) |
| | *Depth* | 300.0 mm (11.8 in) |
| | *Weight* | 2.2 kg (4.7 lb) |
| **Environment** | *Temperature* | Regular option:<br>0 to 50°C (32 to 122°F)<br>Temperature-hardened option:<br>-22 to 70°C (7.6 to 158°F) |
| | *Humidity* | Up to 90%, non-condensing |

## Interfaces

This section provides the technical specifications of the RICi-4E1/T1, RICi-8E1/T1 interfaces.

### E1/T1 Interfaces

The user-traffic interfaces of RICi-4E1/T1, RICi-8E1/T1 are four or eight E1, or four or eight T1 connections.

*Table 1-2. E1 Interface Specification*

| Specifications | E1 Ports |
|---|---|
| Interface | E1 Balanced or unbalanced 75 (with adapter cable) |
| Standards | G.703 |
| Framing | Unframed |
| Data Rate | 2.048 Mbps |
| Line Coding | HDB3 |
| Interface type, connector | Electrical, RJ-45 |

*Table 1-3. T1 Interface Specification*

| Specifications | T1 Ports |
|---|---|
| Interface | T1 Balanced 100 |
| Standards | AT&T TR62411, ANSI T1.403 |
| Framing | D4, ESF |
| Data Rate | 1.544 Mbps |
| Line Coding | B8Zs |
| Interface type, connector | Electrical, RJ-45 |

## Fast Ethernet Interfaces

The network communication in RICi-4E1/T1, RICi-8E1/T1 is channeled through up to four 10/100BaseT Ethernet ports. There is also an option to have two 10/100Base T ports and two fiber optic SFP ports. The interface specifications are listed in *Table 1-4* and *Table 1-5*.

*Table 1-4. Fast Ethernet (10/100BaseT) Interface Specification*

| Specifications | Ethernet Ports |
|---|---|
| Interface | 10/100BaseT Fast Ethernet Interface |
| Standards | Ethernet, Relevant sections of IEEE 802.3, 802.3u, 802.1p and 802.1Q |
| Maximum Frame Size | 1,900 Bytes |
| Data Rate | 100 Mbps |
| Interface type, connector | Electrical, RJ-45 |
| Range | 100 meters/328 feet on UTP category 5 cables |
| Autonegotiation | Supported |
| Flow control | Pause frames |
| Duplex modes | Full/half duplex |

*Table 1-5. Fast Ethernet (100BaseFx) Interface Specification*

| **Specifications** | **Ethernet Ports** |
|---|---|
| Interface | 100BaseFx Fast Ethernet Interface |
| Standards | Ethernet, Relevant sections of IEEE 802.3, 802.3u, 802.1p and 802.1Q |
| Maximum Frame Size | 1,900 Bytes |
| Data Rate | 100 Mbps |
| Interface type, connector | Optical, LC |
| Flow control | Pause frames |
| SFP Supported Types | SFP-1: 1310 nm, 2 km (1.2 miles)<br>SFP-2: 1310 nm, 15 km (9.3 miles)<br>SFP-3: 1310 nm, 40 km (24.8 miles)<br>SFP-4: 1550 nm, 80 km (49.7 miles)<br>SFP-10a: Tx – 1310 nm, Rx – 1550 nm, single fiber, 20 km (12.4 miles) |

# Chapter 2

# Installation and Setup

This chapter includes the following topics:

- Site requirements and specifications
- Package contents
- Required equipment
- Installation and setup.

## 2.1 Introduction

RICi-4E1/T1, RICi-8E1/T1 is shipped ready to use, with factory defaults set. The device is designed as a desktop units or for mounting in a 19-inch rack. For rack installation instructions, refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

After installing the unit, use an ASCII terminal connected to the CONTROL port to perform any configuration necessary. The configuration procedures are described in *Chapter 3* and *Chapter 4*.

In case of problems, refer to *Chapter 6*.

***Warning***

**No internal settings, adjustment, maintenance and repairs should be performed by either the operator or the user. Such activities must be performed only by skilled personnel who are aware of the hazards involved.**

**Always observe standard safety precautions during installation, operation and maintenance of this product.**

## 2.2 Site Requirements and Prerequisites

AC-powered units should be installed within 1.5 meters (5 feet) of an easily accessible grounded AC outlet, capable of supplying the required voltage in the range of 100 to 240 VAC at 50/60 Hz. DC-powered units require 48/60 VDC (40–72 VDC))

Allow at least 90 cm (36 in) of free space in front of the unit to ensure easy operator access. For continuous product operation, allow at least 10 cm of free space at the front and at least 15 cm at the rear of the unit for cable connections and ventilation. For proper ventilation, keep at least 2.5 cm free space from the sides and the top of the unit.

The ambient operating temperature is 0 to 50° C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

## 2.3 Package Contents

The package contains the following items:

- One RICi-4E1, RICi-4T1, RICi-8E1, or RICi-8T1 unit
- AC power cord or DC adaptor connector
- RM-35 kit for mounting in a 19″ rack (if ordered)
- WM-35 kit for mounting a unit on a wall (if ordered).

## 2.4 Required Equipment

RICi-4E1/T1, RICi-8E1/T1 does not require special tools for installation. You only need a screwdriver for mounting the unit in a 19-inch rack.

RICi-4E1/T1, RICi-8E1/T1 is equipped with the appropriate power cable for the respective country or region. You connect the power socket on the rear panel to the mains.

Refer to the following table to determine which cables and connectors are required for installation. *Appendix A* specifies all connector pinouts.

*Table 2-1. Required Connection Media*

| Interface | Cable/Connector |
|---|---|
| Control port | Straight RS-232/V.24 cable with DB-9 female connector for ASCII terminal |
| Fast Ethernet interface | RJ-45, 8-pin connection media |
| E1/T1 interface | RJ-45, 8-pin connection media<br>For an unbalanced E1 interface, use the adapter cable provided |

## 2.5 Mounting the Unit

RICi-4E1/T1, RICi-8E1/T1 is designed for installation as a desktop unit. It can also be mounted in a 19" rack.

- For rack mounting instructions, refer to the RM-34 installation kit manual.
- If RICi-4E1/T1, RICi-8E1/T1 is to be used as a desktop unit, place and secure the unit on a stable, non-movable surface.

Refer to *Handling Energized Products* for safety instructions.

## 2.6 Installing Fiber Optic SFP Modules

Depending on the hardware configuration you purchased, RICi-4E1/T1, RICi-8E1/T1 may use SFP modules with LC fiber optic connectors.

***Warning***

**Third-party SFP optical transceivers must be agency-approved, complying with the local laser safety regulations for Class 1 laser equipment.**

➤ **To install SFP modules:**

1. Lock the wire latch of each SFP module by lifting it up until it clicks into place, as illustrated below.

***Note***

*Some SFP models have a plastic door instead of a wire latch.*

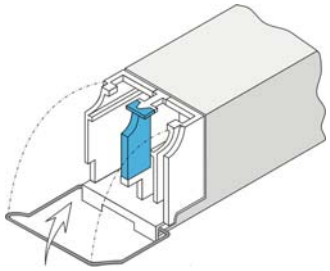


*Figure 2-1. Locking the SFP Wire Latch*

2. Carefully remove the dust covers from the SFP slot.
3. Insert the rear end of SFP into the socket, and push slowly backwards to mate the connectors until the SFP clicks into place. If you feel resistance before the connectors are fully mated, retract the SFP using the wire latch as a pulling handle, and then repeat the procedure.
4. Remove the protective rubber caps from the SFP modules.

➤ **To remove the SFP module:**

1. Disconnect the fiber optic cables from the SFP module.
2. Unlock the wire latch by lowering it downwards (as opposed to locking).
3. Hold the wire latch and pull the SFP module out of the Ethernet port.

## 2.7 Connecting to Ethernet Equipment

RICi-4E1/T1, RICi-8E1/T1 is connected to the Fast Ethernet equipment via the fiber optic LC or 8-pin RJ-45 ports. Refer to *Appendix A* for the RJ-45 connector pinout..

➤ **To connect to Fast Ethernet equipment with fiber optic interface:**

- Connect RICi-4E1/T1, RICi-8E1/T1 to the Ethernet equipment using a standard fiber optic cable terminated with an LC connector.

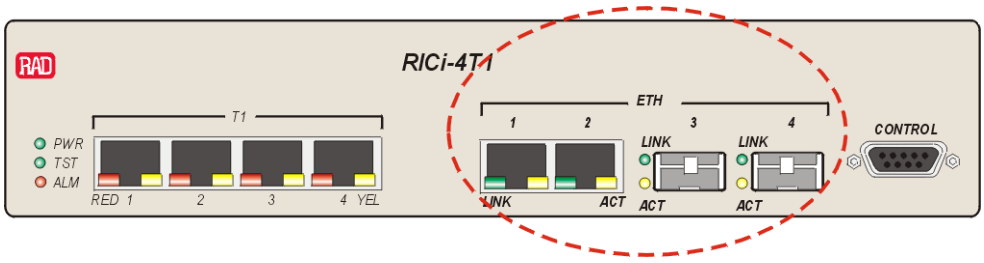



*Figure 2-2. Front Panel - Two 10/100BaseT and two SFP-Based Optical Links*

➤ **To connect to Fast Ethernet equipment with 10/100BaseT interface:**

- Connect the LAN to an RJ-45 connector designated 10/100BaseT.

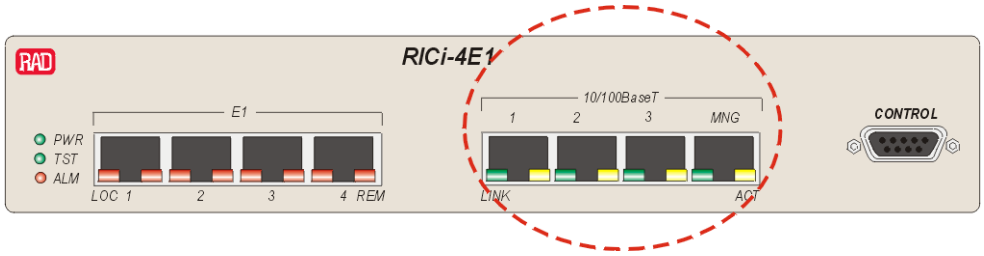



*Figure 2-3. Front Panel – Four 10/100BaseT Links*

## 2.8 Connecting to E1/T1 Equipment

E1/T1 devices are connected to RICi-4E1/T1, RICi-8E1/T1 via 4 or eight balanced RJ-45 ports. An unbalanced E1 interface is provided via the CBL-RJ45/2BNC/E1/X RJ-45 to BNC adapter cable. Refer to *Appendix A* for the connector pinouts.

➤ **To connect to E1 or T1:**

- Connect an E1 or T1 line to an RJ-45 connector labeled E1 or T1 (1–4 or 8).
- For unbalanced E1 connections, use the RAD-supplied adaptor.

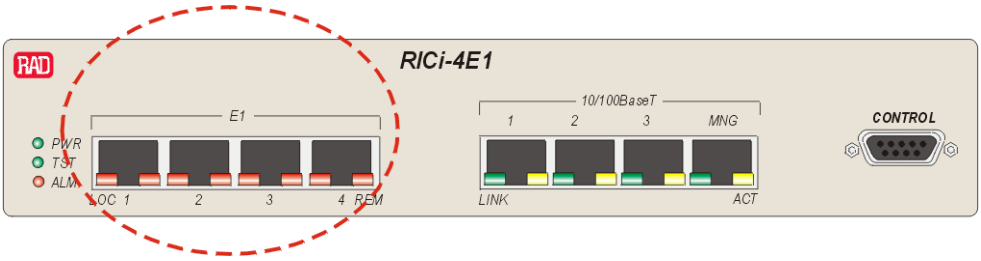



*Figure 2-4. Front Panel – Four E1 Ports*

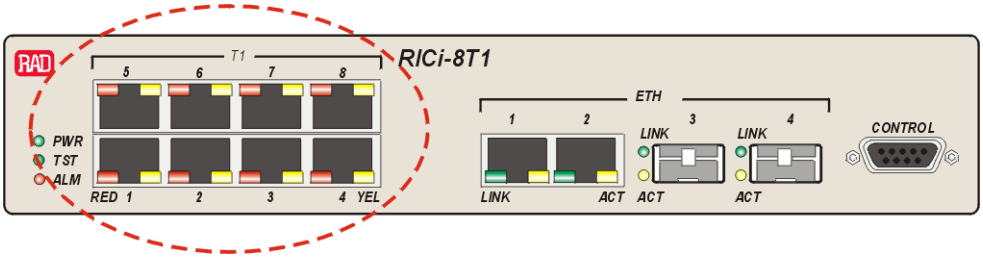



*Figure 2-5. Front Panel – Eight T1 Ports*

## 2.9 Connecting to Management Stations

### Connecting to an ASCII Terminal

RICi-4E1/T1, RICi-8E1/T1 is connected to an ASCII terminal via a 9-pin D-type female connector labeled **CONTROL**. Refer to *Appendix A* for the connector pinout.

➤ **To connect the ASCII terminal:**

1. Connect the male 9-pin D-type connector of the CBL-DB9F-DB9M-STR Control Port cable to the CONTROL connector.
2. Connect the other end of this cable to an ASCII terminal.

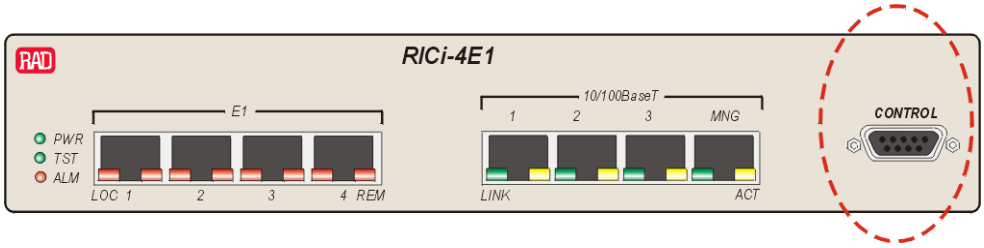



*Figure 2-6. Front Panel – Control Port*

***Caution*** Terminal cables must have a frame ground connection. Use ungrounded cables when connecting a supervisory terminal to a DC-powered unit with floating ground. Using improper terminal cable may result in damage to supervisory terminal port.

## 2.10 Connecting to Power

RICi-4E1/T1, RICi-8E1/T1 is available with AC power or DC power. The power connector is located on the rear panel. Before you connect RICi-4E1/T1, RICi-8E1/T1 to the power, refer to *Handling Energized Product* at the front of this manual.

***Warning***

**Before connecting or disconnecting any communication cable, the unit must be grounded by connecting its power cord to a power outlet with a ground terminal, and by connecting the ground terminal on the panel (if provided) to a protective ground.**

**Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting of the protective ground terminal can make this unit dangerous. Intentional interruption is prohibited.**

### Connecting AC Power

AC power is supplied via a standard 3-prong inlet with an integral fuse holder.

AC power should be supplied through the 1.5m (5 ft) standard power cord terminated by a 3-prong socket. This cord ships with the unit.

➤ **To connect AC power:**

1. Connect the power cord to the power connector on the rear panel of the RICi-4E1/T1, RICi-8E1/T1 unit.
2. Connect the power cord to mains outlet.

   The unit turns on automatically upon connection to the mains.

### Connecting DC Power

The unit ships with a special IEC 60320 adapter to facilitate a -48/-60 VDC power connection.

➤ **To connect DC power:**

- Refer to the DC power supply connection supplement located on the Technical Documentation CD, or at the back of the hardcopy manual, for instructions how to wire the DC adapter. Refer to the *Handling Energized Products* section at the front of this manual for safety instructions.

# Chapter 3

# Operation

This section explains how to get started and operate the unit as follows:

- Explains how to turn the unit on and off
- Provides a detailed description of the front panel controls and indicators and their functions
- Provides instructions for using a terminal connected to the control port of the RICi-4E1/T1, RICi-8E1/T1 unit
- Describes how to navigate menus
- Defines the configuration alternatives.

For a detailed explanation of the parameters in the menus, refer to *Chapter 4*.

## 3.1 Turning On the Unit

➤ **To turn on RICi-4E1/T1, RICi-8E1/T1:**

- Connect the power cord to the mains.

  The PWR indicator turns on and remains on as long as RICi-4E1/T1, RICi-8E1/T1 receives power.

Once installed, RICi-4E1/T1, RICi-8E1/T1 does not require attention except for occasionally monitoring the front panel indicators.

You only have to configure the unit in compliance with local requirements or when performing tests.

## 3.2 Indicators

The unit's LEDs are located on the front panel. *Table 3-1* lists the functions of the LED indicators. The figures below illustrate typical front panels.

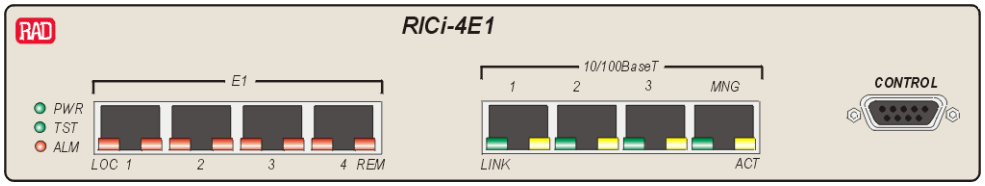



*Figure 3-1. RICI-4E1 - Four 10/100BaseT Links*

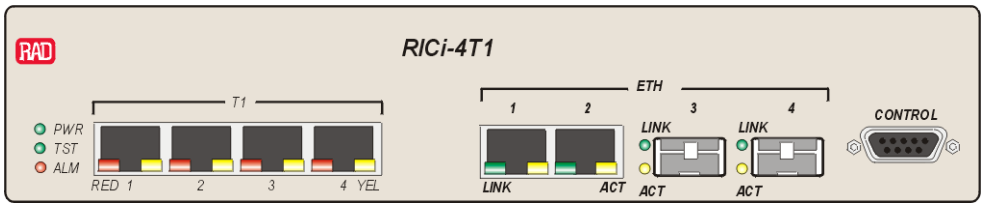



*Figure 3-2. RICI-4T1 - Two 10/100BaseT and Two SFP-Based Optical Links*

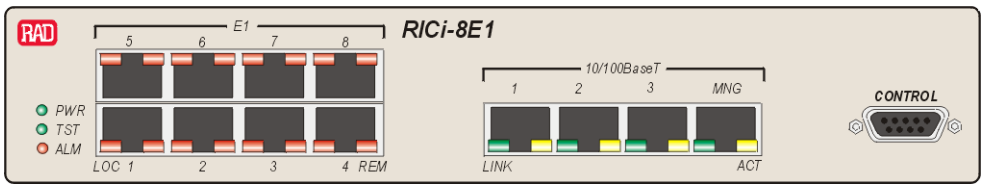



*Figure 3-3. RICI-8E1 - Four 10/100BaseT Links*

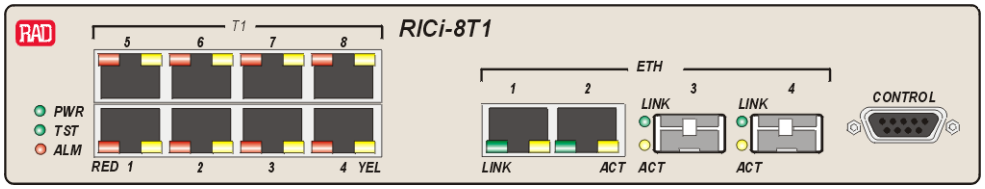



*Figure 3-4. RICI-8T1 - Two 10/100BaseT and Two SFP-Based Optical Links*

*Table 3-1. RICi-4E1/T1, RICi-8E1/T1 LEDs and Controls*

| Name | Color | Function |
|---|---|---|
| PWR | *Green* | **On**: Unit is running<br>**Off**: Unit is off |
| TST | *Green* | **On**: Self test succeeded<br>**Off**: Self test or diagnostics underway |
| ALM | *Red* | **On**: Error on at least one interface<br>**Off**: No alarm |
| LOC for each **E1** port | *Red* | **On**: Local sync loss<br>**Off**: No loss |
| REM for each **E1** port | *Red* | **On**: Remote sync loss<br>**Off**: No loss |
| RED for each **T1** port | *Red* | **On**: Local sync loss<br>**Off**: No loss |
| YEL for each **T1** port | *Yellow* | **On**: Remote sync loss<br>**Off**: No loss |
| LINK for each **Ethernet** port | *Green* | **On**: Ethernet link is active<br>**Off**: Ethernet link is inactive |
| ACT for each **Ethernet** port | *Yellow* | **Blinking**: Ethernet frame received or sent within the last second<br>**Off**: No frame received or sent within the last second |

## 3.3 Default Settings

Some configuration parameters in RICi-4E1/T1, RICi-8E1/T1 may be set to the default values. Configuration parameters set to the default values belong to one of the two following categories:

- **Set/configured defaults**. These defaults are visible when entering the screen, for example the terminal bit rate, which is set to 115200 bps when started.
- **Not set/configured defaults**. These defaults are not visible when entering the screen and are presented by a blank field. They will show after selecting '**Save**' in the respective screen. For example, the default for Ingress Filtering appears once you saved changes in the Bridge Configuration screen.

Configuration parameters without default values assigned require values be assigned, otherwise you will be unable to save the settings.

*Table 3-2* lists the default settings of the RICi-4E1/T1, RICi-8E1/T1 configuration parameters.

*Table 3-2. Default System Settings*

| Parameter | Default Value |
|---|---|
| Device Name | RICi-4E1/RICi-4T1/RICi-8E1/ RICi-8T1 |
| Description | Fast Ethernet over Four/Eight E1/T1 NTU |
| Location | Location of the device |
| Contact Person | Name of the contact person |
| Host IP Address | 0.0.0.0 |
| Host IP Mask | 255.255.255.0 |
| Host Default Gateway | 0.0.0.0 |
| Read Community | Public |
| Write Community | Private |
| Trap Community | Public |
| Host Tagging | Untagged |
| Security Definition | All |
| Telnet/SSH Access | Enable |
| SNMP Access | Enable |
| Web Access | Enable |
| Baud Rate | 115.2 kbps |

*Table 3-3. Default RADIUS Settings*

| Parameter | Default Value |
|---|---|
| Server Sequence Number | 1 |
| Server Status | Not connected |
| Server Access | Disable |
| Server IP Address | 0.0.0.0 |
| Number of Retries | 2 |
| Timeout | 2 |
| Authentication Port | 1812 |

*Table 3-4. Default Syslog Settings*

| Parameter | Default Value |
|---|---|
| Device Logging Status | Disable |
| Device UDP Port | 514 |
| Facility | Local 1 |
| Severity Level | Minor |
| Server Sequence Number | 1 |
| Server Access | Disable |
| Server IP Address | 0.0.0.0 |
| Server UDP Port | 514 |

*Table 3-5. Default E1 Settings*

| Parameter | Default Value |
|---|---|
| Activation | Up |
| Transmit Clock Source | LBT |
| Receiver Sensitivity | -43 |
| Line Code | HDB3 |

*Table 3-6. Default T1 Settings*

| Parameter | Default Value |
|---|---|
| Activation | Up |
| Transmit Clock Source | LBT |
| Frame Type | Framed - ESF |
| Line Mode | CSU |
| Line BuildOut | 0 dB |

| | |
|---|---|
| Sync | Fast |
| Receiver Sensitivity | -36 dB |
| Line Code | B8ZS |

*Table 3-7. Default Ethernet Settings*

| **Parameter** | **Default Value** |
|---|---|
| Port Status | Up |
| Autonegotiation | Enable |
| Max Capability Advertised | 100Base - TX full duplex mode |
| Flow Control | Enable |

*Table 3-8. Default Bridge Settings*

| **Parameter** | **Default Value** |
|---|---|
| Aging Time | 300 |
| Forwarding Mode | Filter |
| VLAN Mode | Unaware |
| Bridge Ports | 1 = Reserved for management host<br>2 = MLPPP<br>3 = Ethernet 1<br>4 = Ethernet 2<br>5 = Ethernet 3<br>6 = Ethernet 4 |

*Table 3-9. Default Bridge Port Settings*

| **Parameter** | **Default Value** |
|---|---|
| Activation | Enable |
| Port VID/Stacking VID | 2 |
| Copy Original Priority | Disable |
| Default Priority Tag | 0 |
| Egress Tag Handling | None |
| Ingress Tag Handling | None |
| TPID (Ether Type) | 8100 |

*Table 3-10. Default OAM Settings*

| **Menu** | **Parameter** | **Default Value** |
|---|---|---|
| End-to-End | Standard OAM MAC Address | 0180C2000030 |

| | | |
|---|---|---|
| | Standard OAM EtherType | 8902 |
| MD Names | MD Format | String |
| Flows | Protocol Type | Standard |
| MAID | MA Format | String |
| MEP | OAM Destination Address Type | Multicast |
| | MD Level | 3 |
| | OAM Mode | Disabled |
| | Continuity Verification Mode | Disabled |
| | CC Interval | 1 sec |
| Service | Performance Monitoring | Disabled |
| | Priority | 0 |
| | Delay Objective | 1 |
| | Delay Variation Objective | 1 |
| | Rising Threshold | 1 or 1E-10 |
| | Falling Threshold | 1 or 1E-10 |
| | Event Reporting Type | None |
| | Sampling Interval | 1 |

## 3.4 Configuration and Management Alternatives

You can locally configure and monitor RICi-4E1/T1, RICi-8E1/T1 from an ASCII terminal connected to the relevant unit's control port, or remotely using ConfiguRAD or RADview-Lite. If you choose the remote option, the relevant PC requires an SNMP agent and a Web browser.

### Working with an ASCII Terminal

RICi-4E1/T1, RICi-8E1/T1 includes a V.24/RS-232 asynchronous DTE port designated CONTROL, which is terminated in a 9-pin D-type female connector. The control port continuously monitors the incoming data stream and immediately responds to any input string received through this port.

The control port can be configured to communicate at the following rates: 9.6, 19.2, or 115.2 kbps.

➤ **To start a terminal control session:**

1. Make sure that all cables are properly connected to the relevant connectors.
2. Connect that the unit is connected to a PC equipped with an ASCII terminal emulation application, for example Hyper Terminal or Procomm.
3. Turn on the control terminal PC and set its default port parameters to 115,200 bits per second, 8 bits/character, 1 stop bit and No Parity.
4. Set the terminal emulator to ANSI VT100 to optimize the view of the system menus.
5. Set the terminal emulator to view a 132-character screen width.
6. Once the system initialized and completed the self-tests, a menu appears displaying the results of the initialization and the self-tests.

#### Logging In

➤ **For read/write permissions:**

1. Under **User Name**, enter **su**.
2. Under **Password**, enter **1234** (default password).

➤ **For read-only permissions:**

1. Under **User Name**, enter **user**.
2. Under **Password**, enter **1234** (default password).

***Note***

- *It is recommended to change default passwords to prevent unauthorized access to the unit.*
- *If you do not enter at least one character within 5 minutes, you will have to log in again.*

## Choosing Options

➤ To choose an option:

1. Type the number corresponding to the option, and press ‹Enter›.
2. If you change any parameter in the menu, the Save option appears as the last option in the menu.

***Note*** *In the OAM menus, the **Save** option does not appear as the last option in the menu. You save changes in the OAM menus by typing **S** and pressing ‹**Enter**›.*

3. To save changes, type the number associated with Save in the respective menu or type S if it is an OAM menu, and press ‹Enter›.

   RICi-4E1/T1, RICi-8E1/T1 updates its database with the new value or displays a new menu for the selected option.

4. If you press ‹ESC› to exit the menu without saving changes, the following message appears:

   "**Do you want to save changes (Y/N/C)?**"

   Type the appropriate letter to save or not save your changes (Yes/No/Cancel).

***Note*** *If a parameter offers only two settings, typing the number associated with the relevant option and pressing ‹**Enter**› will toggle between the two available settings.*

*Figure 3-5* illustrates a typical screen displaying main items.

```
                  Product title line (RICi-4E1)
                          Short message
1. Sub Menu>
2. Sub Menu>
3. Parameter X [Range] …… (value)
4. Parameter Y>           (Select value from the list)
5. Table Z []

prompt>
Main>Configuration>System>

Help line message
Help line of keyboard shortcuts, such as “Esc-prev” for
returning to the previous menu
-----------Division screen line -----------------
Scroll messages
```

*Figure 3-5. Sample Screen*

Some management screens, such as the Inventory table and the Manager table, exceed the size of regular menus and require scrolling to navigate between parameters. In addition, you need to press specific keys to navigate to the desired parameters.

➤ **To navigate inside a table:**

- To scroll left or right, press <**Ctrl**>+L or <**Ctrl**>+R respectively.
- To move to the left or the right, press the Left Arrow or Right Arrow keys.
- To move up or down, press the Up Arrow or Down Arrow keys.
- To move to the next editable cell, press <**Tab**>.
- To navigate to a specific cell, press G<**row number**>, <**col number**>.

➤ **To get help on navigating a table:**

- Press <**?**>; a help screen appears displaying the shortcut keys as illustrated in *Figure 3-6*.

```
                        Table Hot Keys

'L'  - move left
'd'  - scroll down       'D' - move down
'a'  - add row           't' - remove row
'm'  - represent entry as menu
'c'  - clear table
TAB  - select next changeable cell

S <row number>,<col number> - select cell
```

*Figure 3-6. Typical Help Screen*

***Note***

- *Screens are best viewed with the terminal screen width set to 132 characters.*
- *If the respective screen does not have a help screen assigned, an error returns.*

### Ending a Terminal Session

➤ **To end the current terminal session:**

- Press <**&**>.

After ending a session, it is necessary to enter again a valid user name and password to start a new session.

## Working with Web Terminal

Web-based remote access terminal management software provides a user-friendly interface for configuring, collecting statistics and performing tests.

## Web Browser Requirements

- Internet Explorer 6.0 and up, running on Windows™
- Netscape Communicator 7.0 and up, running on Windows™, HPOV or Linux
- Firefox 1.0.4 and up, running on Windows™
- Mozilla 1.4.3 and up, running on Linux.

➤ **Before you start using a Web browser for remote management or monitoring:**

- Enable scripts.
- Configure the firewall that might be installed on your PC to allow access to the destination IP address.
- Disable pop-up blocking software, such as Google Popup Blocker. You may also have to configure spyware and adware protecting software to accept traffic from/to the destination IP address.
- To prevent configuration errors, you must flush the browser's cache whenever you return to the same screen.

## Logging In

➤ **To log in from a Web browser:**

1. Connect the Ethernet port to the LAN.
2. Verify that an IP address has been assigned to the relevant unit, using an ASCII terminal.
3. Open the Web browser.
4. Disable any pop-up blocking software, such as Google Popup Blocker.
5. In the address field, enter the IP address of RICi-4E1/T1, RICi-8E1/T1 and then press ‹**Enter**›. The address line reads something like **http://172.16.100.253.**

   The Opening window appears.
6. Click **LOGIN**; you are asked for the user name and the password.
7. Enter your user name and the password. The default user name for read/write permission is **su** and the default password is **1234**.

   The ConfiguRAD Main menu appears.

***Notes***

- *It is recommended to change default passwords to prevent unauthorized access to the unit.*
- *RICi-4E1/T1, RICi-8E1/T1 allows six management sessions to be active simultaneously: five network sessions (Telnet, ConfiguRAD, RADview-Lite) and one ASCII terminal session.*
- *If no user input is detected for 5 minutes during a ConfiguRAD session, RICi-4E1/T1, RICi-8E1/T1 automatically disconnects from the management station.*

### Navigating the Web Terminal Menus

At the left-hand bottom corner, Web terminal provides auxiliary management tools:

- **Status** – shows the number of users currently managing the unit.
- **Trace** – opens an additional pane for system messages, progress indicators (ping, software and configuration file downloads) and alarms.
- **Refresh All** – refreshes the data currently displayed.

➤ **To choose an option:**

1. In the Web terminal screen, click the desired link to display the next menu.
2. Once the target screen is displayed, select a value from the drop-down box or manually enter it into the field.

## Working with RADview-Lite

RADview-Lite is a user-friendly and powerful SNMP-based element management system (EMS), used for planning, provisioning, and managing heterogeneous networks. RADview-Lite provides capabilities to monitor RAD products and networks using their respective SNMP agents. You can use configuration and diagnostic capabilities via ConfiguRAD.

Contact your local distributor for additional information on RADview-Lite.

## Menu Map

Use the menu tree below as a reference when configuring and monitoring RICi-4E1/T1, RICi-8E1/T1. *Chapter 4* illustrates menus and describes parameters.

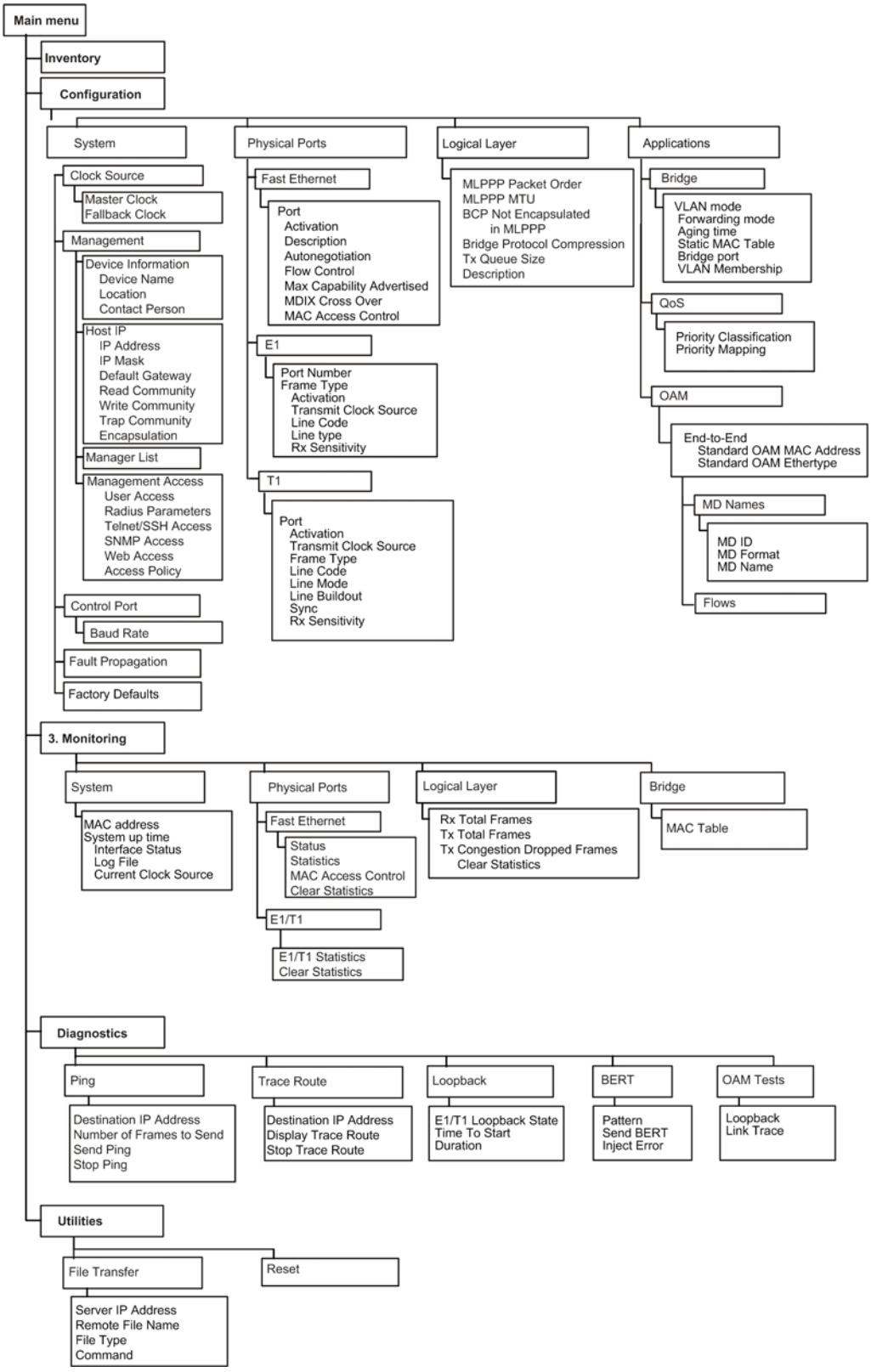



*Figure 3-7. Menu Map*

## 3.5 Turning Off the Unit

➤ **To turn RICi-4E1/T1, RICi-8E1/T1 off:**

- Remove the power cord from the power source.

# Chapter 4

# Configuration

This chapter illustrates the configuration screens and explains their parameters. Examples are given from a terminal screen, but most of the menus are similar for Telnet and Web terminal.

The menu tree of the management software is illustrated in Chapter 3.

## 4.1 Configuring for Management

The initial configuration of management parameters is performed via an ASCII terminal. Once the RICi-4E1/T1, RICi-8E1/T1 host IP parameters are set, it is possible to access them via Telnet or Web terminal to configure the units for operation. Perform the following steps in order to configure the devices for management:

➤ **To configure RICi-4E1/T1, RICi-8E1/T1 for first use:**

- Configuring Host IP Parameters.
- Entering Device Information.
- Configuring Users and Management Access Permissions.
- Configuring Terminal Parameters.

***Note*** *Make sure that you save your settings at each configuration screen.*

## Defining Host IP Parameters

You can manage the unit via a network management station connected to one of the unit's ports. In order to establish a proper connection, you have to configure the host IP address, the subnet mask, the default gateway, and its trap, read and write communities. In addition, it is possible to create a separate management VLAN by selecting forwarding mode and VLAN parameters.

➤ To define the IP parameters:

1. From the Management menu, select **Host IP**.

   The Host IP menu appears.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > System > Management > Host IP
1. IP Address                              ... (0.0.0.0)
2. IP Mask                                 ... (255.255.255.0)
3. Default gateway                         ... (0.0.0.0)
4. Read community                          ... (public)
5. Write community                         ... (private)
6. Trap community                          ... (public)
7. Encapsulation                            >
8. Save

 > Please select item from 1 to 8

ESC-Previous menu; !-Main menu; &-Exit;                1 user(s)
```

*Figure 4-1. Host IP Menu*

2. In the Host IP menu, do the following:
   - Select **IP Address**, and then enter the IP address of the IP host.
   - Select **IP Mask**, and then enter the host IP subnet mask.
   - Select **Default Gateway**, and then enter the default gateway IP address.
   - Select **Read Community**, and then type the name of a community with read-only authorization.
   - Select **Write Community**, and then type the name of a community with write authorization.
   - Select **Trap Community**, and then type the name of a community to which the unit should send traps.
3. Select **Encapsulation** to define VLAN tagging performed by the host.

   The Encapsulation menu appears.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > System > Management > Host IP >
Encapsulation
1. Host tagging                        (Tagged)
2. Host VLAN ID [1-4094]                … (2)
3. Host Priority Tag [0-7]              … (0)
4. Security Definitions                (All)
5. Save

Please select item from 1 to 5
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-2. Encapsulation Menu*

4. From the Encapsulation Menu, select **Host Tagging** to toggle between **Untagged** or **Tagged**.
   - **Untagged**. The host sends and receives frames with no VLAN tag to/from the bridge.
   - **Tagged**. The host receives frames only if they are tagged with the host's VLAN ID, and it sends frames to the bridge with this tag.

***Note***

*When Host Tagging is set to **Tagged**, two parameters are added to the menu, **Host VLAN ID** and **Host Priority Tag**.*

5. Select **Host VLAN ID**, and then specify the Host VLAN ID (1–4094).
6. Select **Host Priority Tag** to specify the priority level for the Host VLAN (0–7).
7. Select **Security Definitions** to specify the management access as follows:
   - ALL. The unit can be managed from all ports
   - OOB Only. The unit defines Fast Ethernet Port 4 as the OOB management port. When this setting is specified, the device can only be managed using the out-of-band option and from the associated port.
8. Select **Save** to save your changes.
9. Return to the Host IP menu and select **Save** to save your changes.

## Entering Device Information

The management application associated with RICi-4E1/T1, RICi-8E1/T1 allows you to assign a name for the unit, to specify its location and assign a contact person to distinguish this unit from others installed in your system. You may enter up to 50 characters into every field.

➤ **To enter device information:**

1. Navigate to Main Menu › Configuration › System › Management › **Device Info**.

   The Device Info menu appears. Refer to *Figure 4-3* for a typical screen. The description for the unit is factory set.

2. Select **Device Name** and type a name for the unit. The default name is the name of the unit: RICi-4E1, RICi-4T1, RICi-8E1, or RICi-8T1.
3. Select **Location** and type a description of the unit's current location.
4. Select **Contact Person** and type the name of a contact person.
5. Select **Save.**

```
                                RICi-4E1
Main Menu > Configuration > System > Management > Device Information
   Description        (Fast Ethernet over 4 E1 Intelligent Converter)

1. Device Name    ... (RICi-4E1)
2. Location       ... (Location of the Device)
3. Contact Person ... (Name of the Contact Person)
4. Save

ESC-Previous menu; !-Main menu; &-Exit;
```

*Figure 4-3. Typical Device Information Menu*

## Controlling Management Access

You can enable or disable access to the RICi-4E1/T1, RICi-8E1/T1 management system via an SNMP, Telnet, or Web-based application. By disabling SNMP, Telnet, or Web access, you prevent unauthorized access to the system. When SNMP, Telnet, and Web access is disabled, RICi-4E1/T1, RICi-8E1/T1 can only be managed using an ASCII terminal. In addition, you can limit access to the device to only the stations defined in the manager list.

➤ **To define the management access method:**

- Navigate to Main Menu › Configuration › System › Management › **Management Access**.

  The Management Access menu appears as illustrated in *Figure 4-4*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Management > Management Access

1. User Access                          >
2. Radius Parameters                    >
3. Telnet/SSH Access                    (Enable)
4. SNMP Access                          (Enable)
5. WEB Access                           (Enable)
6. Access Policy                        >

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-4. Management Access Menu*

➤ To configure Telnet access:

- Select **Telnet** and then choose as follows:
  - **Enable** – All users are enabled.
  - **Managers Only** – Managers listed in the Managers list are enabled.
  - **Secure** – Users using an SSH connection are enabled.
  - **Managers Only Secure** – Managers listed in the Managers list using an SSH connection are enabled.
  - **Disable** – Telnet access is disabled.

➤ To configure SNMP access:

- Select **SNMP** and then choose as follows:
  - **Enable** – All users are enabled.
  - **Enable Managers Only** – Managers listed in the Managers list are enabled.
  - **Disable** – SNMP access is disabled.

➤ To configure Web access:

- Select **WEB** and then choose as follows:
  - **Enable** – All users are enabled.
  - **Enable Managers Only** – Managers listed in the Managers list are enabled.
  - **Secure** – Users using an SSL connection are enabled.
  - **Secure Managers Only** – Managers listed in the Managers list using an SSL connection are enabled.
  - **Disable** – Web access is disabled.

## Configuring User Access

The RICi-4E1/T1, RICi-8E1/T1 management platforms allow you to change current user names and passwords. RICi-4E1/T1, RICi-8E1/T1 supports two user names and passwords. The unit is shipped with the following default settings:

- User name – su, Password – 1234
- User name – user, Password – 1234.

➤ **To change the current user name and password:**

1. Navigate to Main Menu › Configuration › System › Management › Management Access › User Access.

   The User Access menu appears as illustrated in *Figure 4-5*.

2. In the User Access menu, select **User Name** and enter a new user name, which may consist of up to eight characters.
3. Select **Old Password**, and enter the current password. The default is 1234.
4. Select **New Password** and assign a new password, which may consist of up to eight characters.

***Note***

*The password is case sensitive.*

5. Select **Confirm New Password** to confirm the new password.
   - If the new password is incorrect or the confirmed password does not match the newly assigned one, an error returns. Reassign a new password as explained above.
6. Select **Save**.

```
                        RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > System > Management > Management Access > User
Access
  User Level:                          (User)

1. User Name                           … (user)
2. Old Password                        … (********)
3. New Password                        … (********)
4. Confirm New Password                … (********)
5. Save

Please select item from 1 to 5
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-5. User Access Menu*

## Configuring Network Managers

The network management stations to which the SNMP agent sends traps can be defined or modified. Up to ten managers can be defined. Entering the IP address and corresponding subnet mask defines each management station. In addition, you can temporarily prevent a manager station from receiving traps by masking the network manager.

➤ **To edit the manager list:**

1. From the Management menu, select **Manager List**.

   The Manager List menu appears as illustrated in *Figure 4-6*.

2. To add a new network manager, type **a**.

3. Move the cursor to the Manager IP cell you wish to modify by pressing <**Tab**>.

   The selected cell is highlighted and the value appears in the "Change cell" field.

4. Press <**1**>, press <**Enter**>, and then enter a new IP address for the selected network manager.
5. Move the cursor to the **Manager IP Mask** field and enter the subnet mask for the network manager IP address.
6. Move the cursor to the Trap field and toggle between **Mask** and **Unmask** to mask or unmask traps for the selected management station.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > System > Management > Manager List

Manager ID   Manager IP   Manager IP Mask    Manager Trap Mask
    1        1.1.1.1      255.255.255.0      Unmask
    2        2.2.2.2      255.255.255.0      Unmask
    3        3.3.3.3      255.255.255.0      Mask
    4        4.4.4.4      255.255.255.0      Unmask
    5        5.5.5.5      255.255.255.0      Unmask

1. Change cell                        ... (1.1.1.1)
>
A-Add; R-Remove; C-Clear; x-Clear Table
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 4-6. Manager List Menu*

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Management > Manager List
Manager ID              (1)
1. Manager IP           ... (0.0.0.0)
2. Manager IP Mask      ... (255.255.255.0)
3. Manager Trap Mask    ... (Unmask)

 >
S-Save
ESC-prev menu; !-main menu; &-exit;                    1 user(s)
```

*Figure 4-7. Manager List Menu, Add Mode*

## Configuring Radius Client

RICi-4E1/T1, RICi-8E1/T1 provides connectivity to up to four Radius authentication servers.

➤ **To configure Radius parameters:**

1. From the Management menu (Configuration › System › Management), select **Radius Parameters**.

   The Radius Parameters menu appears as illustrated in *Figure 4-8*.

2. Specify the following parameters according to *Table 4-1*:
   - **Server Access**. Enable or Disable
   - **Server IP Address**. The Radius server's IP address
   - **Key String**. Shared secret
   - **Number of Retries and Timeout**. Access-attempt parameters
   - **Authentication Port**. Port used for authentication.
3. To switch to additional Radius servers, type **f** or **b** to navigate forward or backward in the list of servers.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Management > Management Access >
Radius Parameters

   Server Sequence Number                    (1)
   Server Status                        >    (NOT_CONNECTED)
1. Server Access                             (Disable)
2. Server IP Address                    ...  (0.0.0.0)
3. Key String                           ...  ()
4. Number of Retries[0 - 10]            ...  (2)
5. Timeout (in seconds)[1 - 5]          ...  (2)
6. Authentication Port[1 - 65535]       ...  (1812)

Please select item <1 to 6>
F - Forward; B - Backward
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-8. Radius Parameters Menu*

*Table 4-1. Radius Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Server Sequence Number | 1–4<br>The default is 1 | Sequential Radius server number |
| Server Status | Connected<br>Not connected (default)<br>Disconnected | Radius server connection status |
| Server Access | Disable (default)<br>Enable | Enable or disable access to the Radius server |
| Server IP Address | 0.0.0.0 to 255.255.255.255<br>The default is 0.0.0.0 | IP address of the Radius server |
| Key String | User name (case sensitive) | Shared secret between Radius server and user. It is used for encryption |
| Number of Retries | 1-10<br>The default is 2 | Max. number of access attempts |
| Timeout | 1-5<br>The default is 2 | Number of seconds before access attempt fails |
| Authentication Port | 1-65535<br>The default is 1812 | Authentication protocol port |

## Defining the Access Policy

Access policy allows configuration of multiple authentication protocols. User authentication is performed in the order the methods are selected. If the first authentication method is not available, the next selected method is used.

➤ **To define the access policy:**

- From the Management Access menu (Configuration › System › Management › Management Access), select **Access Policy**.

The Access Policy menu appears as illustrated in *Figure 4-9* and *Table 4-2.*

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Management > Management Access >
Access Policy

 1. 1st Level                              (Radius)
 2. 2nd Level                              (Local)

ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-9. Access Policy*

*Table 4-2. Access Policy*

| Parameter | Possible Values | Remarks |
|---|---|---|
| 1st Level | Local<br>Radius | • Local: RICi-4E1/T1, RICi-8E1/T1 uses the locally-stored authentication database<br>• Radius: RICi-4E1/T1, RICi-8E1/T1 uses the authentication database stored on the Radius server.<br>If you select **Radius**, then **2nd Level** becomes available. If the user name is not found in the Radius Server database or the password you enter does not match the user name, the authentication fails.<br>**Default: Local** |
| 2nd Level | None<br>Local | • None: RICi-4E1/T1, RICi-8E1/T1 is available via only the first level.<br>• Local: RICi-4E1/T1, RICi-8E1/T1 uses the locally-stored authentication database.<br>**Default: Local**<br>***Note:*** *This parameter appears only if* ***1st Level*** *is set to Radius.* |

## Configuring Control Port Parameters

The terminal is connected to the Control port. The management software allows you to configure the terminal baud rate.

***Note***

*The Baud Rate parameter is masked during a Telnet session.*

➤ To change the terminal baud rate:

1. Navigate to Main Menu > Configuration > System > Control Port.

   The Control Port menu appears.

2. From the Control Port menu, select Baud Rate.
3. Select the desired baud rate. Available options are 9600, 19200 and 115200 bps (default).
4. Select Save.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > System > Control Port
1. Baud Rate              > (115200 bps)
2. Save
 >
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-10. Control Port Menu*

# 4.2 Configuring for Operation

The recommended operation configuration procedure includes the following stages:

- Setting device-level parameters
- Setting logical layer parameters
- Setting physical layer parameters.

## Setting Device-Level Parameters

This section instructs you on selecting the clock source and the fault propagation.

### Selecting the Clock Source

You can assign two sources of timing to the unit, a master clock and a fallback clock that takes over if the master clock becomes unavailable. These timing sources can be used to ensure that all devices in the network synchronize to a single clock source.

You can assign the master and the fallback clocks as the unit's internal clock or as the clock for a specific E1/T1 link.

***Note*** *It is recommended to apply different settings to the master clock and the fallback clock, for example **Rx Clock** for the master clock and **Internal** for the fallback clock.*

➤ **To select the clock sources:**

1. Navigate to Main Menu › Configuration › System › Clock Source › **Master Clock**.

   The Master Clock Source menu appears.

2. Press ‹ **1** › to toggle the first-priority clock options:
   - **Internal**, if you want the master clock to be the unit's internal clock.
   - **Rx Clock**, if you want the master clock to be the clock for a specific E1/T1 link.
3. If you have chosen **Rx Clock**, specify the port to be used, **E1/T1 Port 1..4 or 8**.
4. Select **Save**.

   The master clock source settings are saved.

5. Return to the Clock Source menu (Main Menu › Configuration › System › **Clock Source**) and select **Fallback Clock**.

   The Fallback Clock Source menu appears.

6. Press ‹ **1** › to toggle the second-priority clock options:
   - **Internal**, if you want the fallback clock to be the internal clock of the relevant unit.
   - **Rx Clock**, if you want to set the fallback clock to refer to a specific E1/T1 link.
7. If you have chosen **Rx Clock**, specify the port to be used: **E1/T1 Port 1..4 or 8.**
8. Select **Save**.

## Configuring Fault Propagation

When **Network - › User fault propagation** is enabled, the LAN ports are closed whenever the MLPPP uplink becomes inactive.

When **User - › Network fault propagation** is enabled, the following two configuration modes are available:

- **Interface Deactivation**. The MLPPP will be deactivated whenever an administratively enabled LAN port is closed.
- **OAM Signaling**. Applying an 802.3ah OAM mechanism, all administratively enabled LAN ports in the peer device are closed if one of the local device's administratively enabled LAN ports is closed while the MLPPP remains active. One of the Ethernet ports remains unaffected, in order to leave a management channel open.
  This applies to #4 in four copper devices and to #2 in 2 copper and 2 SFP devices.

➤ **To enable or disable fault propagation in a specific direction:**

1. Navigate to Main Menu › Configuration › System › **Fault Propagation**.
2. **Network - › User Fault Propagation**. Toggle between **Interface Deactivation** or **Disable**.
3. **User - › Network Fault Propagation**. Toggle between **Interface Deactivation, OAM Signaling** or **Disable**.
4. Select **Save**.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Fault Propagation

1. Network - >  User Fault Propagation      (Disable)
2. User - >  Network Fault Propagation      (Disable)
3. Save

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-11. Fault Propagation Screen*

## Setting Physical Layer Parameters

RICi-4E1/T1 has four E1/T1 ports, RICi-8E1/T1 has eight E1/T1 ports; all units have four fast Ethernet interfaces, three user traffic ports and one port for out-of-band management. You access the Fast Ethernet and E1/T1 configuration menus from the Physical Ports menu.

### Configuring Ethernet Interface

The following parameters can be configured for the Ethernet ports at the physical level:

- **Activation**
- **Description**. Free text that is added to traps about this port
- **Autonegotiation**. On non-copper ports only
- **Flow Control**
- **Maximum advertised capability for autonegotiation procedure**. On copper ports only
- **Data rate and duplex mode**. Only when autonegotiation is disabled and on copper ports only
- **MDIX Auto Cross Over**. On copper ports only
- **MAC Access Control** – You can specify that the port accepts traffic only from the first MAC address(es) from which it receives traffic.

➤ **To configure the Fast Ethernet port:**

1. Navigate to Main Menu › Configuration › **Physical Ports**.

   The Physical Ports menu appears.

2. Select **Fast Ethernet**.

   The Fast Ethernet menu appears as illustrated in *Figure 4-12*.

3. Configure the Fast Ethernet port parameters. Refer to *Table 4-3* for additional information.

➤ **To configure MAC port protection for the Fast Ethernet port:**

1. In the Fast Ethernet menu select **MAC Access Control**.

   The MAC Access Control menu appears as illustrated in *Figure 4-13*.

2. Configure the MAC Access Control parameters. Refer to *Table 4-4* for additional information.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main menu > Configuration > Physical ports > Fast Ethernet

   Port                            (1)

1. Activation                      (Up)
2. Description                     (ETH 1)
3. Auto Negotiation                (Enable)
4. Flow Control                    (Enable)
5. Max Capability Advertised       (100base – TX Full Duplex)
6. MDIX Cross Over                 (Enable)
7. MAC Access Control              >

f – forward
Please select item from 1 to 6
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-12. Fast Ethernet Menu*

*Table 4-3. Fast Ethernet Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Port number | 1–4<br>The default is 1 | Refers to the Fast Ethernet port number. This parameter is read-only. |
| Activation | Up (default)<br>Down | Activates the Fast Ethernet link. |
| Auto-negotiation | Enable (1) Disable (2) | Enables autonegotiation signaling over the Ethernet. |
| Flow Control | Enable (default)<br>Disable | Configures the default administrative PAUSE mode for this interface. |
| Max Capability Advertised | 10baseT Half Duplex<br>10baseT Full Duplex<br>100baseTX Half Duplex<br>100base TX Full Duplex (default) | Specifies the set of capabilities advertised by the local auto-negotiation entity. |
| MDIX Auto Cross Over | Enable (default)<br>Disable | Enables and disables **Auto Cross Over**. |

```
                    RICi-4E1/T1, RICi-8E1/T1
Main menu > Configuration > Physical ports > Fast Ethernet >
MAC Access Control

   Port                                      ...   (1)
   Current Number of Protected Addresses     ...   (0)
1. MAC Protection Administrative Status      >     (Disable)
2. Maximum Number of Protected MAC Addresses       (0)

>
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-13. MAC Access Control Menu*

*Table 4-4. MAC Access Control Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Port number | 1–4<br>The default is 1 | Refers to the Fast Ethernet port number. This parameter is read-only. |
| Current Number of Protected Addresses | | Shows the current number of learned MAC Addresses being protected. This parameter is read-only. |
| MAC Protection Administrative Status | Disable<br>Enable<br>The default is Disable | Indicates if MAC port protection is disabled or enabled for the port. If enabled, the port accepts traffic only from the first MAC address(es) from which it receives traffic. |
| Maximum Number of Protected MAC Addresses | | Specifies the maximum number of source MAC addresses from which the port is allowed to receive traffic. |

## Configuring E1 Interface

➤ To configure the E1 ports:

1. Navigate to Main Menu › Configuration › Physical Ports menu › **E1**

   The E1 menu appears as illustrated in *Figure 4-14*.

2. Configure E1 port parameters. Refer to *Table 4-5* for additional information.

   Press ‹**F**› to change the E1 port number.

3. Select **Save**.

4. Repeat the above procedure for additional E1 ports in use.

```
                        RICi-4E1, RICi-8E1
Main menu > Configuration > Physical ports > E1

   Port [1 – 8]                (1-8)
   Frame type  >               (Unframed)
1. Activation                  (Up)
2. Transmit clock source       (LBT)
3. Line code                   (HDB3)
4. Line type                  >(Unbalanced)
5. Rx Sensitivity
6. Save


f – forward
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-14. E1 Port Configuration Menu*

*Table 4-5. E1 Port Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Port number | 1–Number of E1 ports (4 or 8)<br>The default is 1 | Index of E1 ports. |
| Frame type | Unframed | Defines frame type. |
| Activation | Enable/Up (default)<br>Disable/Down | Sets the administrative status of the E1 port. |
| Transmit clock source | Loopback Timing (default)<br>Internal Clock<br>System | Transmits the clock source of the E1 port. |
| Line Code | HDB3 (default)<br>AMI | Indicates the transmission line code. |
| Line Type | Balanced (default)<br>Unbalanced | |
| Rx Sensitivity | -12 db<br>-43 db (default) | |

## Configuring T1 Interface

➤ To configure the T1 ports:

1. Navigate to Main Menu › Configuration › **Physical Ports**.

   The Physical Ports menu appears.

2. From the Physical Ports menu, select **T1**.

   The T1 Port Configuration menu appears as illustrated in *Figure 4-12*.

3. Configure T1 port parameters. Additional information is available in *Table 4-3*.

   - To switch to a different port, press ‹**F**› and configure the parameters respectively.

4. Select **Save**.
5. Repeat the above procedure for additional T1 ports in use.

```
                    RICi-4T1, RICi-8T1
Main menu > Configuration > Physical ports > T1
   Port                                (1)
1. Activation                          (Up)
2. Description                    ... (T1 Link 1)
3. Transmit clock source           >  (LBT)
4. Frame type                      >  (Framed-ESF)
5. Line Code                          (B8ZS)
6. Line Mode                          (CSU)
7. Line BuildOut                   >  (0 dB)
8. Sync                               (FAST)
9. Rx Sensitivity                     (-15 dB)
 > _

f - Forward
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-15. T1 Port Configuration Menu*

*Table 4-6. T1 Port Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Port | 1–Number of T1 ports (4 or 8) | Index of T1 ports. |
| Activation | Up (default) Down | Set the administrative status of the T1 port. |
| Description | Alphanumeric characters | Description of T1 port |
| Transmit clock source | LBT (default)<br>Internal<br>System Clock | Transmit clock source of the T1 port. |
| Frame type | ESF (default)<br>D4 | This parameter indicates which T1 Lines implement this type of circuit. The type of circuit affects the number of bits per second that the circuit can reasonably carry, as well as the interpretation of the usage and error statistics. |
| Line Code | B8ZS (default)<br>AMI | Indicates the transmission line code. |
| Line Mode | DSU<br>CSU (default) | T1 interface type. |
| Line BuildOut (dB) | 0 dB (default)<br>-7.5 dB<br>-15 dB<br>-22.5 dB | Controls the link transmit signal. |

| Parameter | Possible Values | Remarks |
|---|---|---|
| Line Length | 0-133 ft (default)<br>134-266 ft<br>267-399 ft<br>400-533 ft<br>534-655 ft | Controls the link transmit signal. |
| Sync | FAST (default)<br>AT&T 62411 | The restore time parameter is used to change the synchronization algorithms to reduce the time required for the port to return to normal operation after local loss of synchronization (LOF event). |
| Rx Sensitivity | -15 dB<br>-36 dB (default) | Controls the sensitivity of the receive equalizer. |

## Setting Logical Layer Parameters

The unit bonds multiple E1/T1 ports utilizing Multilink Point-to-Point Protocol (MLPPP), bridging the bandwidth gap between E1/T1s, and creating a large virtual pipe. *Figure 4-16* illustrates the Logical Layer Configuration screen.

➤ **To configure the logical layer parameters:**

6. Navigate to Main Menu › Configuration › **Logical Layer**.
7. Configure the parameters as specified in *Table 4-7*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main menu > Configuration > Logical Layer

 1. MLPPP Packet Order                          (Enable)
 2. MLPPP MTU [80-1900]                    ... (280)
 3. BCP Not Encapsulated in MLPPP               (Disable)
 4. Bridge Protocol Compression                 (Enable)
 5. TX Queue Size (# of frames)[25 - 275]  ... (275)
 6. Description                                 (MLPPP Link)


ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-16. Logical Layer Menu*

*Table 4-7. Logical Layer Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| MLPPP Packet Order | Enable (default)<br>Disable | Logic Interface MLPPP, rearranges the order of packets sent, relative to the E1 port number. This may cause delays if packets of very different sizes are sent. |
| MLPPP MTU | 80-1900<br>The default is 280 | Maximum Transmit Unit. This is the maximum fragment size that may be transmitted over the E1 lines. |

| Parameter | Possible Values | Remarks |
|---|---|---|
| BCP Not Encapsulated in MLPPP | Enable<br>Disable (default) | Indicates whether the BCP message is encapsulated in the MLPPP header, for the case of remote interfaces that require it to be encapsulated.<br>If set to **Enable**, the BCP message is not encapsulated. If **Disable**, it is encapsulated. |
| Bridge Protocol Compression | Enable (default)<br>Disable | Indicates whether to compress the Bridge Protocol field in the MLPPP header to one byte instead of two bytes. The field is compressed by removing the first byte, which contains zeros. |
| TX Queue Size | 25 - 275<br>The default is 275 | Specifies the size of the queue towards the E1/T1 interface. Selecting a higher size allows you to handle large bursts although delays may be longer, while selecting a lower size causes fewer delays but limits the burst size. |
| Description | | Provides a description of the link. |

# Setting Application-Level Parameters

## Configuring the Bridge

The internal bridge connects the ports of the unit. In order to maintain priority for the data flow, the bridge must be configured to process the VLAN tags.

The bridge operates in Transparent mode (learning is disabled) or Filtered mode (learning and filtering are enabled).

➤ **To configure the internal bridge:**

1. Navigate to Main Menu › Configuration › Applications › **Bridge**.

   The Bridge menu appears as illustrated in *Figure 4-17*.

2. Configure the Bridge parameters as described in *Table 4-10*:
3. For Bridge Port configuration, refer to *Configuring the Bridge Ports*
4. For VLAN Membership configuration (in VLAN-aware bridge only), refer to *Configuring VLAN Membership*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > Applications > Bridge
1. VLAN Mode                      (Aware)
2. Forwarding Mode                (Transparent)
3. Aging Time (sec)[300-4080]  …(300)
4. Static MAC Table               >    []
5. Bridge port                     >
6. VLAN membership                 >
7. Save

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-17. Bridge Menu*

*Table 4-8. Bridge Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| VLAN Mode | Aware<br>Unaware (default) | Forwarding is based on MAC address only or on VLAN+MAC.<br>**Aware** –Bridge forwarding is based on VLAN+MAC, according to 802.1Q<br>**Unaware.** Bridge forwarding is based on MAC address only, according to 802.1D |
| Forwarding Mode | Filter (default)<br>Transparent | Determines whether the bridge learns MAC addresses.<br>**Filter** – Learning and filtering are enabled.<br>**Transparent** – No learning is performed. Each received packet is forwarded to all other ports automatically, unless static MAC is used |
| Aging Time (sec) | 300–4080 | Aging time for entries in the MAC table. If the aging time elapses and no frame has been received from the MAC, it is erased from the MAC table.<br>The default is 300 seconds. |

## Configuring the Static MAC Table

Static MAC addresses are stored in the MAC table.

➤ **To add a static MAC address:**

1. From the Bridge menu, select **Static MAC Table**.

   The Static MAC Table appears with VLAN ID entries for a VLAN-aware bridge only, as illustrated in *Figure 4-18*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > Bridge > Static MAC Table
             VLAN ID       MAC Address       Receive Bridge Port
   1         1             111111111111       1
|  2         2             222222222222       2
v  3         3             333333333333       3
   4         4             444444444444       4
   5         5             555555555555       5
x – Clear Table

ESC-prev menu; !-main menu; &-exit; ?-help
```

*Figure 4-18. Static MAC Table*

2. In the Static MAC Table menu, press ‹**a**› to add a static MAC address.

   The Static MAC Table display changes to Add mode as illustrated in *Figure 4-19*.

```
                    RICi-4E1/T1, RICi-8E1/T1
MAC table handling
1. VLAN ID                      (1)
2. MAC Address                … (00-00-00-00-00-00)
3. Receive Bridge Port [1-6]    (1)
4. Save

Please select item from 1 to 4
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 4-19. Static MAC Table, Add Mode*

3. In Add mode, do the following:
   - Select **MAC Address**, and enter a new MAC address.
   - Select **VLAN ID**, and choose a VLAN ID for the MAC address within the range of 1–4094.
   - Select **Receive Bridge Port**, and choose the interface this MAC address should be attached to.
   - Select **Save** to save the MAC address.
4. Press ‹**ESC**› to return to the Static MAC Table.

➤ **To remove a static address from the table:**

- In the Static MAC Table menu, select a MAC address that you want to remove and press ‹**R**›.

  The MAC address is deleted from the table.

➤ **To clear the MAC table:**

1. In the Static MAC Table menu, press ‹**X**›.

   The following message appears: **`Are you sure (Y/N)?`**
2. Press ‹**Y**› to confirm deletion of all MAC addresses from the table.

## Configuring the Bridge Ports

The internal bridge parameters, as well as the bridge ports and the VLAN membership must be configured according to the application requirements.

Available settings and factory-set (default) configuration are listed in *Table 4-10*.

➤ **To configure a bridge port:**

1. Navigate to Main Menu › Configuration › Applications › Bridge › **Bridge Port**.
2. The Bridge Port menu appears as illustrated in *Figure 4-20*.
3. In the Bridge Port menu, select a bridge port.
4. Configure the bridge port as specified in *Table 4-9*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > Bridge > Bridge Port
1. Bridge port [1 – 6]                      (2)
2. Bind
3. Activation                               (Enable)
4. Ingress Filtering                        (Disable)
5. Copy Original Priority                   (Disable)
6. Default Priority Tag [0 - 7]            …(4)
7. Egress Tag Handling                      (Stacking)
8. Ingress Tag Handling                     (Stripping)
9. TPID (Ether Type) [0 - ffff]             (8100)
10. Save

f-Forward ; b-Backward; g-Go To ; d-Delete
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 4-20. Bridge Ports Menu*

*Table 4-9. Bridge Port Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Bridge Port Number | 1–6 | Bridge port number.<br>Bridge port 1 is reserved for the host bridge port.<br>Press <F> to switch the port numbers. |
| Activation | Enable (default)<br>Disable | Specifies if this port is active. |
| Port VID / Stacking VID | 1–4094<br>The default is 2 | This is the PVID, the VLAN ID assigned to untagged frames or priority-tagged frames received on this port. If stacking is enabled, this is the tag to be added. |
| Copy Original Priority | Enable<br>Disable | Enable: The priority tag of the original VLAN is copied if a frame arrives with a stacked VLAN tag, otherwise the default priority is used.<br>Disable: The default priority is used. |
| Default Priority Tag | 0–7<br>The default is 0 | Default VLAN frame priority. Applies to untagged frames and when per-port priority is used.<br>If stacking is enabled, this value is used for priority. |
| Egress Tag Handling | Stacking<br>Stripping<br>None (default) | **Stacking.** adds the PVID to every frame transmitted from the port.<br>**Stripping.** removes the first VLAN tag from every transmitted frame, on the egress of the port. |
| Ingress Tag Handling | Stacking<br>Stripping<br>None (default) | **Stacking.** adds the PVID to every frame received on the ingress of the port.<br>**Stripping.** removes the first VLAN tag from every received frame, on the ingress of the port. |
| TPID (Ether Type) | 0 - 0xFFFF | The associated Ethernet type (TPID) is used in all bridging, stacking and stripping operations done on packets arriving or outgoing of this port. |

## Binding Bridge Ports

The unit is supplied with the bridge ports pre-bound to the physical interfaces as listed in *Table 4-10*. Usually there is no need to modify the default bridge bindings.

*Table 4-10. Factory Set Bridge Port Bindings*

| Bridge Port | Bound to |
|---|---|
| 1 | Reserved for management host |
| 2 | MLPPP |
| 3 | Ethernet 1 |
| 4 | Ethernet 2 |
| 5 | Ethernet 3 |
| 6 | Ethernet 4 |

➤ **To bind a bridge port:**

1. From the Bridge Ports menu, select a bridge port.
2. Select **Bind** to define a physical port to be bound to the current bridge port.

   The Bind menu appears.

***Note***

*Bridge port 1 is permanently bound to the management host.*

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Application > Bridge > Bridge port > Bind
1. Type                                  (Fast)
2. Fast Ethernet [1-4]                  …(1)
3. Save

Please select item from 1 to 3
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 4-21. Bridge Ports Bind Menu*

3. From the Bind menu, select **Type** and choose the port type to which the bridge port should be bound: **Fast** (Fast Ethernet) or **MLPPP**.
4. If you selected **Fast** in the previous step, select **Fast Ethernet** and type the number of the Ethernet port (1-4), which you want to bind the bridge port to.
5. In the Bridge Port Bind menu, select **Save**.
   Press ‹**ESC**› to return to the Bridge Ports menu.
6. In the Bridge Port menu, configure the Bridge Port parameters as listed in *Table 4-9*. The settings pertain to the port to which you bound the bridge port in the previous steps.
7. Select **Save**.

***Note***

*The bridge has six bridge ports (BP). BP1 is dedicated to the IP Host. BP2 through BP6 can be bound to Fast-Ethernet ports 1–4 or to the MLPPP bundle.*

*Note that PPP/MLPPP does not synchronize unless a bridge port has been bound to the MLPPP bundle.*

## Configuring VLAN Membership

➤ **To configure VLAN Membership:**

1. Navigate to Main Menu › Configuration › Applications › Bridge › **VLAN Membership**.

   The VLAN Membership menu appears as illustrated in *Figure 4-22*.

2. Select **VLAN ID**, and type the VLAN ID you wish to configure.
3. Select **Egress Tagged Ports.** Packets carrying this VLAN tag will be transmitted 'untouched' (i.e. the VLAN tag remains attached).
4. Select **Egress Untagged Ports.** This VLAN tag will be removed from the packets before they are transmitted.
5. Select **Save** to finish VLAN Membership configuration.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > Applications > Bridge > VLAN
Membership
1. VLAN ID                                  (1)
2. Egress Tagged Ports                   >      (1, 2)
3. Egress Untagged Ports                 >      (6)
4. Save                                  >

f-Forward ; b-Backward; g-Go To ; d-Delete
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-22. VLAN Membership Menu*

## Configuring Quality of Service (QoS)

Three methods of traffic classification are supported:

- 802.1 priority mapping
- DSCP priority mapping, using tag values
- Priority mapping per Ethernet port.

The classification method is chosen using the Priority Classification menu.

Four traffic queues are supported, which can be assigned priorities using the Priority Mapping menu.

➤ **To select a traffic classification method:**

1. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Classification.**

   The Priority Classification menu appears as illustrated in *Figure 4-23*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Configuration > Applications > QoS > Priority
Classification
1. 802.1p
2. DSCP
3. Per Port

ESC-Previous menu; !-Main menu; &-Exit;
```

*Figure 4-23. QoS Priority Classification Menu*

2. From the Priority Classification menu, select the desired traffic classification method: **802.1p**, **DSCP**, or **Per Port**.
3. Select **Save**.

➤ **To assign priorities to traffic queues for 802.1p:**

1. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Classification**.
2. Following the above procedure, select **802.1p** as the desired traffic classification method.
3. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Mapping**.

   The Priority Mapping (802.1p) menu appears as illustrated in *Figure 4-24*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > QoS > Priority Mapping(802.1p)
1. User Priority 0  >  (Traffic Class 0)
2. User Priority 1  >  (Traffic Class 0)
3. User Priority 2  >  (Traffic Class 1)
4. User Priority 3  >  (Traffic Class 1)
5. User Priority 4  >  (Traffic Class 2)
6. User Priority 5  >  (Traffic Class 2)
7. User Priority 6  >  (Traffic Class 3)
8. User Priority 7  >  (Traffic Class 3)

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-24. Priority Mapping Menu (802.1p)*

4. From the Priority Mapping menu, select the desired priority (0 – 7) and enter the assigned traffic queue number (0 – 3). Each traffic queue can be assigned to more than one priority.

   These are priority queues, i.e. packets arriving with lower priority will only be transmitted after all packets with higher priority have been transmitted. It implies possible starvation of lower priority traffic in case higher priority traffic uses all available bandwidth.

***Note*** *Class 0 (the default one) has lowest priority, 3 highest.*

5. Repeat steps 1 – 3 for all priorities.
6. Select **Save**.

➤ **To assign priorities to traffic queues, for DSCP:**

1. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Classification**. Following the previous procedure, select **DSCP** as the desired traffic classification method.
2. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Mapping**.

   The Priority Mapping (DSCP) menu appears as illustrated in *Figure 4-25*. The menu lists only those values that have been changed from their default values.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > QoS > Priority Mapping(DSCP)

1. Tag Value  0   >      (Traffic Class 2)
2. Tag Value 63   >      (Traffic Class 2)


a – add
ESC-prev menu; !-main menu; &-exit;
```

*Figure 4-25. Priority Mapping Menu (DSCP)*

3. From the Priority Mapping menu, select the desired tag value (0 – 63) and enter the assigned traffic queue number (0 – 3). Each traffic queue can be assigned to more than one tag. To add a new entry, select **a** (add) and enter the tag value and traffic queue number.
   To remove an entry, assign Traffic Class 0 to it.
4. Repeat for all tag values you wish to change.
5. Select **Save**.

➤ **To assign priorities to traffic queues per bridge port:**

1. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Classification**. Following the above procedure, select **Per Port** as the desired traffic classification method.
2. Navigate to Main Menu › Configuration › Applications › QoS › **Priority Mapping**.

   The Priority Mapping (Per Port) menu appears as illustrated in *Figure 4-26*.
3. From the Priority Mapping menu, select the desired bridge port.
4. Select **Traffic Class** and enter the traffic queue number (0 – 3) to be assigned to the bridge port. Each traffic queue can be assigned to more than one port.
5. Repeat steps 1 – 4 for all active bridge ports.
6. Select **Save**.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > QoS > Priority Mapping(Per Port)
   Bridge Port (1-6)          …(5)
1. Traffic Class               >  (Traffic Class 0)
 >
f – Forward; b – Backward; g – Go To
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-26. Priority Mapping Menu (Per Port)*

## Configuring OAM

RICi-4E1/T1, RICi-8E1/T1 provides operation, administration, and maintenance (OAM) in packet-switched networks.

➤ To access the OAM menu:

1. From the OAM (Configuration › Applications › OAM) menu, select End-To-End.

   The OAM End-To-End menu appears.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End

1. MD Names
2. Standard OAM MAC Address          ... (0180C2000030)
3. Standard OAM EtherType[0 - ffff] ... (8902)
4. Flows

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-27. OAM End-To-End Menu*

*Table 4-11. OAM End-To-End Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| MD Names | | Maintenance Entity Group ID's domain name. |
| Standard OAM MAC Address | | Specifies the MAC Address for Operation and Maintenance.<br>Default: 0180C2000030 |
| Standard OAM EtherType | 0 - ffff | Specifies the Operation and Maintenance EtherType.<br>Default: 8902 |
| Flows | | Ethernet Virtual Connections. |

2. Modify the OAM MAC Address and/or the Standard OAM Ether Type as needed, according to application requirements.
3. Save your changes.

### *Configuring Maintenance Domains*

A Maintenance Domain (MD) is a domain or part of a domain for which the faults in connectivity are managed. Each Maintenance Domain is administered separately. Each Maintenance Domain is assigned a Maintenance Domain Name. The name must be unique among all those used or available to an operator, and to facilitate easy identification of administrative responsibility for the Maintenance Domain. RICi-4E1/T1, RICi-8E1/T1 lets you add or remove maintenance domains as explained below.

➤ To view and edit existing MDs:

1. In the OAM End-to-End menu, type **f** or **b** to scroll forward or backward respectively through the MDs.

   The associated MD ID, MD format, and MD name appear.

2. Modify the MD format and the MD name as needed.
3. Save your changes.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > MD Names

   MD ID [1 – 8]                    ... (2)
1. MD Format                        >   (String)
2. MD Name                          ... (None)

Please select item <1 to 2>
A-Add New MD Name; F-Forward; B-Backward; D-Delete
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-28. MD Names Menu*

➤ To add a maintenance domain (MD):

1. In the OAM MD Names menu, type **A**.

   The new MD ID and its parameters appear as illustrated in *Figure 4-29*.

2. Specify the desired MD format and the MD name.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > MD Names

   MD ID [1 – 8]                    ... (2)
1. MD Format                        >   (String)
2. MD Name                          ... (None)

Please select item <1 to 2>
S-Save
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-29. MD Names Menu, adding MD*

*Table 4-12. MD Names Menu*

| Parameter | Possible Values | Remarks |
|---|---|---|
| MD ID | | The maintenance domain's ID |
| MD Format | None<br>String<br>DNS Like<br>MAC + UINT | Indicates maintenance group entity ID's (MEG ID) domain name format.<br>None – No name defined<br>String – Alphanumeric value<br>DNS Like –DNS format<br>MAC + UINT – MAC and UINT format.<br>**Default: String** |
| MD Name | | Indicates maintenance group entity ID's (MEG ID) domain name. One MD name (**None**) remains by default.<br>**Default:**<br>• **None if MD Format is String or DNS Like format**<br>• **0000000000000000 if MD Format is MAC + UINT** |

➤ **To delete an MD:**

- To delete an MD, in the OAM MD Names menu type **d**.

### *Configuring OAM Flows*

An OAM flow is an association of devices used for OAM message exchange. The RICi-4E1/T1, RICi-8E1/T1 units support up to eight flows.

➤ **To view existing OAM flows:**

1. From the OAM **End-To-End (**Configuration › Applications › OAM › End-To-End) menu, select **Flows**.

   The OAM Flow menu appears.

2. To view configured flows, type **f** to scroll forward or **b** to scroll backward through the list.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > Flows

   Flow[1 – 8]                        ... (0)

A-Add New Flow  ; F-Forward ; B-Backward ; D-Delete
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-30. Flows Menu*

➤ **To add a flow:**

1. To add a flow, type **A** and enter the desired flow ID.

   The new flow appears as illustrated in *Figure 4-31*.

2. Configure the flow parameters as specified in *Table 4-13.*

3. Save your changes.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > Flows

   Flow[1 – 8]                          ... (1)
1. Flow Name                             ... (Put your String here)
2. SP VLAN[1 – 4094]                     ... (1)
3. Protocol Type                             (Standard)
4. MAID
5. MEP

Please select item <1 to 1>
A-Add New Flow  ;
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-31. Flows Menu, Adding Flow*

*Table 4-13. OAM Flow Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow | 1 – 8 | Flow ID |
| Flow Name | | Assign a name to the relevant flow. |
| SP VLAN | 1 – 4094 | Specify the VLAN used to send the OAM for the specified Maintenance Entity Group (MEP). |
| Protocol Type | Proprietary<br>Standard | Proprietary refers to RAD's proprietary OAM protocol. If you choose **Proprietary**, you only have to configure **MEP**.<br>**Default: Standard** |
| MAID | | Refers to the Maintenance Association ID. This parameter only appears if Protocol Type is set to **Standard**. |
| MEP | | Refers to the Maintenance Entity Group End Point. |

➤ **To configure the maintenance association's ID (MAID):**

1. Select **MAID**.

   The MAID menu appears as illustrated in *Figure 4-32*.

2. Configure the MAID parameters as specified in *Table 4-14*.
3. Save your changes.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > Flows > MAID

   Flow ID                          ... (1)
1. MD ID[1 – 8]                    ... (1)
   MD Format                         >  (None)
   MD Name                              (None)
2. MA Format                         >  (String)
3. MA Name                         ... ()

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-32. MAID Menu*

*Table 4-14. MAID Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | | Displays the Flow ID. |
| MD ID | 1 - 8 | Select the ID of the desired maintenance domain (MD ID) |
| MD Format | | Displays the selected maintenance domain's format (MD Format) |
| MD Name | | Displays the name assigned to the selected maintenance domain (MD Name). |
| MA Format | String<br>Primary Vlan<br>Unsigned Int 16<br>ICC | Select the maintenance association's format (MA Format).<br>**Default: String** |
| MA Name | | Assign a name to the maintenance association (MA Name)<br>**Default**:<br>• **DEFAULT if MA Format is String or ICC format**<br>• **0 if MA Format is Unsigned Int 16**<br>• **SP VLAN configured earlier if MA Format is Primary VLAN** |

➤ **To configure the maintenance entity group's end point (MEP)**

1. Select **MEP**.

   The MEP menu appears as illustrated in *Figure 4-33*.

2. Configure the MEP parameters as specified in *Table 4-15*.
3. Select **Save**.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > Flows > MEP

   Flow ID                          ... (1)
1. Local ID[0 – 8191]               ... (0)
2. OAM Destination Address Type         (Multicast)
3. Remote ID                        >   (-)
4. MD Level[0 - 7]                  ... (3)
5. OAM Mode                         >   (Disable)
6. Continuity Verification Mode     >   (CC Based)
7. OAM Destination MAC Address        > (0120D2000103)
8. Default CC Priority                > (0)
9. CC Interval                      >   (1 Second)
10. Services

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-33. MEP Menu*

*Table 4-15. MEP Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | | Displays the Flow ID. |
| Local ID | 1 - 8191 | Indicates the maintenance entity group's end point.<br>**Default: Undefined (there is no default value)** |
| OAM Destination Address Type | Multicast<br>Unicast | Determines the MAC address sent in OAM messages, which may be the standard OAM MAC address that was configured previously in standard mode or the RAD proprietary multicast address in proprietary mode or a user-defined unicast address.<br>**Default: Multicast** |
| Remote ID | 1 – 8191 | The Remote MEP ID is the ID that identifies incoming OAM messages. Every unit's ID must be unique, therefore the local and remote ID must not be identical. |
| MD Level | 0–7 | OAM domain level<br>**Default: 3**<br>***Note:*** *This parameter is configurable only in standard mode.* |
| OAM Mode | Disabled<br>Initiate<br>React | Determines the OAM behavior.<br>**Disabled** –No CC performed,<br>**Initiate** – The unit initiates and responds to OAM messages,<br>**React** – The unit responds to OAM messages, but does not initiate them.<br>**Default: Disabled** |
| Continuity Verification Mode | LB Based<br>CC Based | Determines the CC behavior. **LB Based** is used only for RAD proprietary.<br>**Default: Disabled**<br>***Note****: This parameter is available in Initiate/React OAM mode and RAD Proprietary mode.* |

| Parameter | Possible Values | Remarks |
|---|---|---|
| OAM Destination MAC Address | MAC Address | Determines the MAC address sent in OAM messages, configurable only for Unicast MAC Address.<br>**Default: 000000000000 in Unicast, 0120D2000100 + MD Level in Multicast RAD Proprietary, Standard OAM MAC Address + MD Level in Multicast Standard** |
| CC Interval | 100ms<br>1 sec<br>10 sec<br>1 min<br>10 min | Sets the CC interval between messages.<br>**Default: 1 sec**<br>***Note:*** *This parameter is configurable only in standard mode.* |
| Default CC Priority | | The priority CFM message is sent if no service is defined for the flow. If a service is defined, the CC is performed at the highest priority service for the flow. |
| Services | | Refer to *Figure 4-34* and *Table 4-16*<br>***Note:*** *This parameter is available only in proprietary mode.* |

➤ **To configure the flow services:**

1. From the MEP menu (Configuration › Applications › OAM › End-To-End › Flows › MEP), select **Services**.

   The Services menu appears.

2. Configure the parameters as specified in *Table 4-16*.
3. Save your changes.

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End-To-End > Flows > MEP >
Services

   Service                                  ... (1)
1. Performance Monitoring                   ... (Enabled)
2. Priority                                 ... (0)
3. Delay Objective (msec)                   ... (0)
4. Delay Variation Objective (msec)         ... (0)

   Event Reporting
5. Frame Loss Ratio                            >
6. Frames Above Delay                          >
7. Frames Above Delay Variation                >
8. Unavailability Ratio                        >

F-Forward;
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-34. Service Menu*

*Table 4-16. Service Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Service | 1 – 3 | Three services are automatically created for each defined flow. |
| Performance Monitoring | Enabled<br>Disabled | Enables/disables Performance Monitoring<br>**Default: Disabled** |
| Priority | 0 – 7 | Determines the P-bit value sent inside the OAM message that originates from this service.<br>**Default: 0** |
| Delay Objective | 1 – 1000 | Determines the delay objective for the specified service.<br>**Default: 1** |
| Delay Variation Objective | 1 – 1000 | Determines the delay variation objective for the specified service<br>**Default: 1** |
| Frame Loss Ratio | | Refer to *Figure 4-35* and *Table 4-17* |
| Frames Above Delay | | Refer to *Figure 4-35* and *Table 4-17* |
| Frames Above Delay Variation | | Refer to *Figure 4-35* and *Table 4-17* |
| Unavailability Ratio | | Refer to *Figure 4-35* and *Table 4-17* |

```
                    RICi-4E1/T1, RICi-8E1/T1
Configuration > Applications > OAM > End To End > Flows > MEP >
Services > Frames Above Delay

1. Rising Threshold             ... (0)
2. Falling Threshold            ... (0)
3. Sampling Interval            ... (0)
4. Event Reporting Type         ... (Trap and Log)

Please select item <1 to 1>
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-35. Event Reporting Menu Screen*

*Table 4-17. MEP Services Event Reporting Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Rising Threshold | 1 – 4294967296<br>For Unavailability Ratio / Frame Loss Ratio, the values are: 1E-3,1E-4,1E-5, 1E-6,1E-7,1E-8,1E-9,1E-10 | A value above this threshold within the sampling interval for the specified counter will be considered a rising event.<br>**Default: 1, or 1E-10 for Unavailability Ratio / Frame Loss Ratio** |
| Falling Threshold | 1 – 4294967296<br>For Unavailability Ratio / Frame Loss Ratio, the values | A value above this threshold within the sampling interval for the specified counter will be considered a falling event. |

| Parameter | Possible Values | Remarks |
|---|---|---|
| | are: 1E-3,1E-4,1E-5, 1E-6,1E-7,1E-8,1E-9,1E-10 | **Default: 1, or 1E-10 for Unavailability Ratio / Frame Loss Ratio** |
| Sampling Interval | 1 – 4294967296 | The interval in seconds above which the data is sampled and compared with the rising and falling thresholds.<br>***Note**: This parameter is available only in the Frames Above Delay and Frames Above Delay Variation menus.* |
| Event Reporting Type | None<br>Log<br>SNMP Trap<br>Trap and Log | The Event type sent out after passing the threshold.<br>**Default: None** |

## 4.3 Additional Tasks

This section describes additional operations available supported by the RICi-4E1/T1, RICi-8E1/T1 management software, including the following:

- Configuring MAC port protection
- Setting the date and time
- Displaying inventory
- Transferring software and configuration files
- Resetting the unit.

### Configuring Date and Time

RICi-4E1/T1, RICi-8E1/T1 receives the date and the time from the network clock using an NTP client. This causes the system to show the correct time and date (and not the time of starting the system, which is the default.

➤ **To configure the NTP client:**

- Navigate to Main Menu › Configuration › System › **Date and Time**.

The Date and Time menu appears.

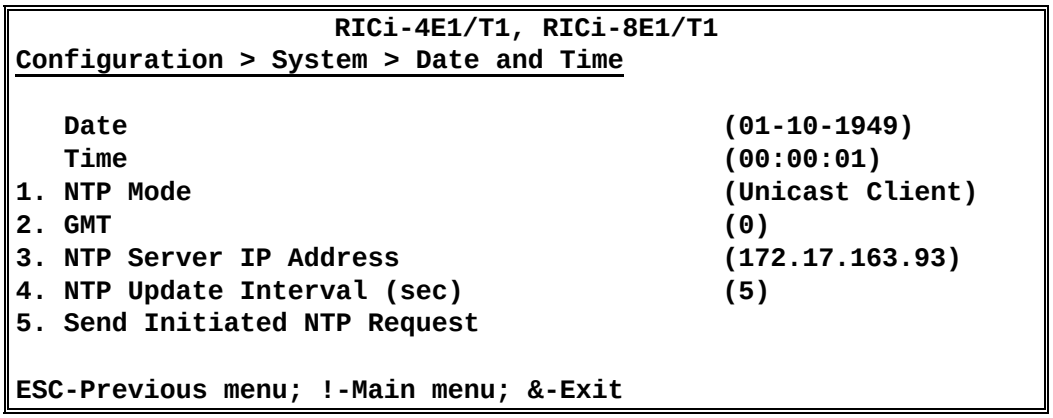

RICi-4E1/T1, RICi-8E1/T1
Configuration > System > Date and Time
Date (01-10-1949)
Time (00:00:01)
1. NTP Mode (Unicast Client)
2. GMT (0)
3. NTP Server IP Address (172.17.163.93)
4. NTP Update Interval (sec) (5)
5. Send Initiated NTP Request
ESC-Previous menu; !-Main menu; &-Exit

*Figure 4-36. Date and Time Screen*

*Table 4-18. NTP Client Parameters*

| Parameter | Possible Value | Remarks |
|---|---|---|
| NTP Mode | Unicast Client<br>Disable (Default) | NTP request sent to a specific IP address |
| GMT | -12 – 12<br>The default is 0 | Offset from Greenwich Main Time |
| NTP Server IP Address | The default is 0.0.0.0 | The NTP server's IP address. |
| NTP Update Interval (sec) | 0 (disable), default<br>1 - 4294967295 | The time in seconds between NTP update requests. |
| Send Initiated NTP Request | | Click to submit an NTP update request. Initiated update requests do not affect the specified update interval. |

## Configuring the Syslog Parameters

Syslog enables you to forward log messages via UDP over the network to up to five Syslog servers. To allow logging/sharing of system events to the Syslog servers, you need to configure the Syslog and Syslog server(s) parameters.

➤ **To configure the Syslog parameters:**

1. Navigate to the Syslog menu (Configuration › System › **Syslog**).

   The Syslog menu appears.

2. Configure the parameters as described in *Table 4-19*.

```
Configuration>System>Syslog

1. Device Logging Status                > (Disable)
2. Device UDP port [1 – 65535]          > (514)
3. Facility                             > (Local 1)
4. Severity level                       > (Minor)
5. Server Parameters                    >

>

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-37. Syslog Menu*

*Table 4-19. Syslog Parameters*

| Parameter | Values | Remarks |
|---|---|---|
| Device Logging Status | Disable (default)<br>Enable | Specifies whether transmitting syslog messages is enabled or disabled |
| Device UDP Port | 1–65535 | UDP Port used by RICi-4E1/T1, RICi-8E1/T1 to transmit the Syslog messages |
| Facility | Local 1 (default) -<br>Local 7 | The software module, task, or function from which the Syslog messages are sent |
| Severity Level | Critical – corresponds to the Emergency (0) severity level of Syslog<br>Major– corresponds to the Alert (1) and Critical (2) severity levels of Syslog<br>Minor (default) – corresponds to the Error (3) severity level of Syslog<br>Warning – corresponds to the Warning (4) severity level of Syslog<br>Event– corresponds to the Notice (5) severity level of Syslog<br>Info– corresponds to the Informational (6) severity level of Syslog<br>Debug – corresponds to the Debug (7) severity level of Syslog | The log messages with severity levels that equal or exceed the selected severity level are transmitted |

➤ To configure Syslog server parameters:

1. Navigate to the Syslog Server Parameters menu (Configuration › System › Syslog › Server Parameters).

   The Syslog Server Parameters menu appears.

2. Configure the parameters as described in *Table 4-20*.

```
        Configuration>System>Syslog> Server Parameters

Server Sequence Number                ...   (1)
 1. Server Access                           >    (Disable)
 2. Server IP Address                 ...   (0.0.0.0)
 3. UDP Port[1 – 65535]               ...   (514)

>

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 4-38. Syslog Server Parameters Menu*

*Table 4-20. Syslog Server Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Server Sequence Number | 1–5 | Shows which Syslog server is being configured |
| Server Access | Disable (default)<br>Enable | Controls the access to the Syslog server |
| Server IP Address | 0.0.0.0 – 255.255.255.255 | IP address of the Syslog server |
| Server UDP Port | 1–65535 | UDP Port of the Syslog server |

## Viewing Inventory

The RICi-4E1/T1, RICi-8E1/T1 inventory displays information on current software and hardware revisions of the unit. It also provides the RICi-4E1/T1, RICi-8E1/T1 interface description.

➤ **To display the inventory:**

- From the Main menu, select **Inventory**.

  The Inventory table appears. *Figure 4-39* illustrates the first half of the inventory table. Use the arrow keys to navigate through the table.

The inventory displays a description of the unit including its hardware revision and the power supply type in use.

***Note***

*The inventory is a wide table with 132 characters. It is best viewed by setting your terminal to 132 character wide display.*

```
                                RICi-4E1
Main Menu > Inventory

  ID      Description        Vendor type  Class     Entity name       HWRev
  1001    RICi-4E1 Device          Chassis          RICi-4E1          1.00
  4001    Power Supply              Power Supply     PS
| 7001    Fast Eth Port 1           Port             FAST 1
v 7002    Fast Eth Port 2           Port             FAST 2
  7003    Fast Eth Port 3           Port             FAST 3
  7004    Fast Eth Port 4           Port             FAST 4
  7005    E1 Port 1                 Port             E 1
  7006    E1 Port 2                 Port             E 2
  7007    E1 Port 3                 Port             E 3
  7008    E1 Port 4                 Port             E 4
      - >  >

 >
```

*Figure 4-39. Typical Inventory Screen*

## Transferring Software and Configuration Files

This section presents procedures for installing new software releases on the RICi-4E1/T1, RICi-8E1/T1 units, and transferring configuration files.

Two software versions are stored, each of them in one of the two partitions of its flash memory, which also contains a boot program. The software is stored in compressed format. The active version is decompressed and loaded into the unit's RAM upon power-up. The passive software is kept for backup purposes. If the active software becomes corrupted, you can swap it with the backup. By default, the unit is delivered with active software only.

New software releases are distributed as ***.img** files, which are downloaded to RICi-4E1/T1, RICi-8E1/T1. When starting a download, the current backup is erased and the new software placed in the backup partition. When downloading is complete, the unit checks the integrity of the new software file. If it is correct, the backup and active files are swapped. The new software release becomes active and the former active software becomes the backup. If a failure occurs while downloading, the new version is erased. In this case, only one version is left stored in the flash memory.

Configuration files can be uploaded for storage and backup.

➤ **To transfer files via TFTP:**

1. Navigate to Main menu > Utilities > **File Transfer**.

   The File Transfer menu appears as illustrated in *Figure 4-40*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Utilities > File Transfer
1. Server IP Address …                    (0.0.0.0)
2. Remote File Name  …                    ()
3. File Type                              (Configuration)
4. Command            >

Please select item from 1 to 4
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 4-40. TFTP Menu*

2. In the File Transfer menu, select **Server IP Address,** and enter the TFTP server's IP address.
3. Select **Remote File Name** and enter a file name.
4. Select **File Type** and choose whether you intend to transfer a software program (IMG) or a configuration file.
5. Select **Save**.
6. Select **Command** to start the desired procedure:
   - **Upload** – saving a software or configuration file on a remote server
   - **Download** – transferring a software or configuration file to the unit.

   RICi-4E1/T1, RICi-8E1/T1 starts the file transfer.

The TFTP file transfer process is logged by the system messages listed below, which are stored in the log file. For additional information, refer to *Chapter 6*.

- TFTP – Starting Upload
- TFTP – Starting Download
- TFTP – Upload Failed
- TFTP – Download Failed.

## Resetting RICi-4E1/T1, RICi-8E1/T1

This section describes two types of reset functions:

- Resetting configuration parameters to the default settings
- Resetting the device to the factory settings.

### Returning to Factory Defaults

You can reset the unit to its default settings.

➤ **To reset to the default settings:**

1. Navigate to Main Menu › Configuration › System › **Factory Defaults**.

   You are asked to confirm this request:

```
The device will restart with default configuration, proceed?
                          (Y/N)
```

2. Press <**Y**> to confirm.

   The unit resets and all parameters revert to their default settings.

## Resetting the Unit

You can perform an overall reset of the unit.

➤ **To reset RICi-4E1/T1, RICi-8E1/T1:**

1. Navigate to Main Menu > Utilities > **Reset**.

   You are asked to confirm this request:

```
The device will restart. Do you want to proceed? (Y/N).
```

2. Press <**Y**> to confirm.

   The unit resets.

# Chapter 5

# Configuring a Typical Application

This chapter provides detailed instructions on configuring a typical application to use a unit for customer premises with in-band management and a VLAN-aware bridge.

## 5.1 Application Requirements

*Figure 5-1* illustrates a typical application, in which a unit connects Ethernet with four E1 links.

*Figure 5-1. Typical Application*

➤ Network requirements:

- 4 E1s and 4 VLANs
- 1 Fast Ethernet
- 1 Network Manager
- Bridge (Aware) and six Bridge Ports.

## 5.2 Configuring the Management Parameters

This part of the application configuration procedure consists of three major stages:

- Defining the host
- Defining the default gateway
- Defining managers.

### Defining the Host

Defines the host parameters such as IP address and subnet mask, and the read/write communities.

➤ **To define the host:**

1. Navigate to Main › Configuration › System › Management › **Host IP**.

   The Host IP menu appears.

2. Define the host parameters as follows:
   - Select **Address** to define the IP address of the SNMP host.
   - Select **Mask** to define the host IP subnet mask.
   - Select **Default Gateway** to set the default gateway IP address.
   - Select **Read Community** to enter the name of a community with read-only authorization.
   - Select **Write Community** to enter the name of a community with write authorization.
   - Select **Trap Community** to enter the name of a community to which traps are sent.
3. Press ‹**ESC**› to return to the Management menu.

### Defining the Default Gateway

Makes the unit available from outside your network.

➤ **To define the default gateway:**

1. Navigate to Main › Configuration › System › Management › **Host IP**.

   The Host IP menu appears.

2. In the Host IP menu, select **Default Gateway**.
3. Enter the IP address of the default gateway server or specify an IP address of 0.0.0.0 to disable the default gateway.

## Defining Managers

In this step you define the managers and specify which manager(s) will receive SNMP traps.

Up to ten managers can be defined. Entering the IP address and corresponding subnet mask defines each management station. In addition, you can temporarily prevent a manager station from receiving traps, by masking the network manager.

➤ **To access the manager list:**

- Navigate to Main › Configuration › System › Management › **Manager List**

  The existing managers appear listed.

➤ **To define new managers:**

1. Press ‹**a**›.

   A form appears to enter the details for the new manager. An ID is automatically assigned to the new manager.

2. Specify an IP address for the new manager under **Manager IP**.
3. In the Trap field, specify **Mask** or **Unmask** to mask or unmask traps for the new management station.
4. Select **Save All**.
5. Repeat the previous steps for each network manager you wish to add.

➤ **To update existing manager parameters:**

1. In the Manager list, press **‹Tab›** to move the cursor to the Manager IP cell you wish to modify by pressing.

   The selected cell is highlighted and the value is displayed in the "Change cell" field.

2. Press ‹**1**›, and press ‹**Enter**› to enter a new IP address for the selected network manager.
3. Move the cursor to the Trap field and toggle between **Mask** and **Unmask** to mask or unmask traps for the selected management station.
4. Repeat the previous three steps for each manager you wish to update.
5. Press ‹**ESC**› to return to the Management menu.

## 5.3 Configuring E1/T1 Physical Layer

Defines the characteristics of the physical E1 or T1 ports. Set the clock parameters.

➤ **To configure the E1/T1 physical layer:**

1. Navigate to Main › Configuration › Physical layer › **E1/T1**.

   The E1 or T1 menu appears as appropriate.

2. Leave the parameters unchanged.
   Refer to *Configuring Ports at the Physical Level* for additional information on defining the parameters for each T1/E1 physical port.
3. Press ‹**ESC**› to return to the Physical Layer menu.
4. Press ‹**ESC**› to return to the Configuration menu.

## 5.4 Configuring the Bridge

This part of the application configuration procedure has four major stages:

- Defining the bridge
- Defining bridge ports and binding them to the relevant physical interfaces
- Defining VLANS and adding them the relevant bridge ports
- Configuring the E1/T1 physical layer.

### Defining the Bridge

➤ **To define the bridge:**

1. Navigate to Main › Configuration › Application › **Bridge**.

   The Bridge menu appears.

2. Define the bridge parameters. For additional information on each parameter, refer to *Configuring the Internal Bridge*.

## Defining Bridge Ports

The unit is supplied with the bridge ports preconfigured for basic use and do not need to be reconfigured. The factory-set configuration is shown in *Table 5-1*. To reconfigure the ports, the configuration for each port must first be deleted. Refer to *Configuring the Bridge Ports* for additional information.

*Table 5-1. Default Bridge Port Settings*

| Bridge Port | Configured to |
|---|---|
| 1 | Reserved for management host |
| 2 | MLPPP bundle |
| 3 | Ethernet 1 |
| 4 | Ethernet 2 |
| 5 | Ethernet 3 |
| 6 | Ethernet 4 |

## Defining VLAN Memberships

Define the required VLAN and add to it the relevant bridge ports.

➤ **To define a VLAN:**

1. Navigate to Main › Configuration › Application › Bridge › **VLAN Mode**.

   The VLAN Mode menu appears.

2. Leave the parameters at their default settings (Unaware).
   To define and create a new VLAN, refer to *Configuring the Internal Bridge* for additional information.

3. Add the relevant ports to the defined VLAN (including the Host bridge port if it is the VLAN used for management).

# Chapter 6

# Troubleshooting and Diagnostics

This section describes how to do the following:

- Monitoring the system performance
- Displaying status and statistics
- Displaying system messages
- Detecting errors
- Troubleshooting the device
- Performing connectivity tests.

## 6.1 Monitoring Performance

The software provides access to the following status information:

- System level – MAC address, connection status, log file, and clock source
- Physical level – Ethernet and E1 port status
- Application level – MAC table.

The status information is available via the Monitoring menu.

### Viewing System Status Information

The System menu shows the Log file, and shows the interface connection status. For a description of system messages, which are displayed via the Log file screen, refer to *Chapter 6*.

➤ **To display interface connection information:**

- Navigate to Main Menu › Monitoring › System › **Interface Status**.

  The Interface Status screen appears as illustrated in *Figure 6-1*. It includes the following:

  - **Interface description**. Fast Ethernet, E1, MLPPP, and bridge ports
  - **Type**. Interface type
  - **Activation**. Indicates whether the interface is enabled (Up) or disabled (Down), as user defined via the Ethernet menus (refer to *Chapter 4*).
  - **Operation**. The link's current operational status (Up or Down).

```
                                RICi-4E1
Main Menu>Monitoring>System>Interface Status
 Description        Type              Activation  Operation  Speed
 ETH 1              Fast Eth          Up          Up         100000000
 ETH 2              Fast Eth          Up          Up         100000000
 ETH 3              Fast Eth          Up          Up         100000000
 ETH 4              Fast Eth          Up          Up         100000000
 E1 PORT 1 BL       E1                Up          Up         2048000
 LOGICAL PORT MLPPP MLPPP Port        Up          Up         16384000
 LOGICAL PORT 1     Logical PPP       Up          Up         2048000
 Bridge Port 6      Bridge Port       Up          Up         100000000

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-1. Typical Interface Status Screen*

## Viewing Physical Layer Status

You can view the status of the unit's physical ports.

For a description of the Ethernet and E1 port statistics, refer to *Viewing Interface Statistics*.

### Displaying Ethernet Port Status

➤ To display the Ethernet port status:

- Navigate to Main Menu › Monitoring › Physical Port › Fast Ethernet › **Status**.

  The Fast Ethernet Status screen appears as illustrated in *Figure 6-2*. It includes the following:

  - **Activation**. Indicates whether the interface is enabled or disabled
  - **Status**. The link's current data rate and duplex mode
  - **Flow Control** – indicates whether Flow Control is enabled or disabled.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Monitoring>Physical Ports>Fast Ethernet>Status
 Port (1)
 Activation              (Enable)
 Status                  (Up)
 Speed & Duplex          (100Mbps - Full Duplex)
 Flow Control            (Enable)

ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 6-2. Ethernet Status Screen*

### Displaying Ethernet MAC Port Protection Status

➤ To display the Ethernet MAC port protection status:

1. Navigate to Main Menu › Monitoring › Physical Port › Fast Ethernet › **MAC Access Control**.

The MAC Access Control Status screen appears as illustrated in *Figure 6-3*. It includes the following:

- **Current Number of Protected Addresses**. Shows the current number of learned MAC Addresses being protected
- **Maximum Number of Protected MAC Addresses**. Shows the maximum number of protected MAC addresses that can be learned.

2. Select **Protected MAC Addresses** to view the protected MAC addresses.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main menu > Monitoring > Physical ports > Fast Ethernet > MAC
Access Control

   Port                                      ...   (1)
   Current Number of Protected Addresses     ...   (0)
   Maximum Number of Protected MAC Addresses       (0)
1. Protected MAC Addresses                         []
>
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 6-3. MAC Access Control Menu*

## Viewing Application-Level Status

At the application level, the unit provides information of the MAC addresses (static and learned) and their bridge port assignments; as well as VLAN IDs and their bridge port assignments.

### Displaying the MAC Table

➤ **To display the MAC table:**

- Navigate to Main Menu›Monitoring›Bridge›**MAC table**.

  The MAC Table screen appears as illustrated in *Figure 6-4*. It includes the following:

  - **VLAN ID**. The VLAN ID corresponding to the MAC address (VLAN-aware mode only)
  - **MAC Address**. Existing MAC address
  - **Receive Bridge Port**. Bridge port number.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Monitoring>Bridge>MAC Table

       VLAN ID      MAC Address      Bridge Port Status
  1    1            111111111111     1           Learned
| 2    2            222222222222     2           Learned
v 3    3            333333333333     3           Learned
  4    4            444444444444     4           Learned

ESC-prev menu; !-main menu; &-exit; ?-help
```

*Figure 6-4. Static MAC Table*

## Viewing Interface Statistics

You can display statistical data for the Ethernet and E1 ports, and the bundled logical layer.

### Displaying Ethernet Statistics

➤ **To view Ethernet statistics:**

1. Navigate to Main › Monitoring › Physical Ports › **Fast Ethernet**.
2. Type **<f>** to navigate to the desired port.
3. Select **Statistics.**

   The Fast Ethernet Statistics screen appears as illustrated in *Figure 6-5*.

➤ **To clear Ethernet statistics:**

- In the Fast Ethernet Statistics menu, type **1** to clear port statistics.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Monitoring>Physical Port>Fast Ethernet>Statistics
   Port                    (1)
   Rx Correct Frames                              … (0)
   Rx Correct Octets                              … (0)
   Rx FCS Errors                                  … (0)
   Tx Correct Frames                              … (0)
   Tx Correct Octets                              … (0)
   Tx Collision                                   … (0)
   Tx Congestion Dropped Frames                   … (0)

 1. Clear Port Statistics
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-5. Fast Ethernet Statistics*

*Table 6-1. Ethernet Statistics*

| Parameter | Description |
|---|---|
| Rx Correct Frames | The total number of correct frames received |
| Rx Correct Octets | The total number of octets (bytes) received |
| Rx FCS Errors | Total number of frames received with a valid length, but with invalid FCS and an integral number of octets |
| | Total number of valid frames received that are discarded due to a lack of buffer space |
| Tx Correct Frames | The number of frames successfully transmitted |
| Tx Correct Octets | The number of octets successfully transmitted |
| Tx Collision | Total number of successfully transmitted frames that experienced one or more collisions |
| Tx Congestion Dropped Frames | Total number of valid frames that could not be transmitted due to a lack of buffer space |

## Displaying E1/T1 Statistics

➤ **To view E1/T1 port statistics:**

1. Navigate to Main › Monitoring › Physical Ports › **E1/T1**.

   The E1/T1 menu appears.

2. Type **f** to select the Port number.
3. Select **E1/T1 Statistics**.

   The E1 or **T1** Statistics screen appears as illustrated in *Figure 6-6*. The statistics are described in *Table 6-2*.

➤ **To clear statistics:**

- In the Statistics menu, select **Clear Statistics** to clear all E1/T1 statistics.

```
                    RICi-4E1, RICi-8E1
Main Menu>Monitoring>Physical Port>E1>E1 Statistics

  Rx Total Frames                ( )
  Rx Total Octects               ( )
  Rx Total Errors                ( )
  Tx Total Frames                ( )
  Tx Total Octects               ( )
  Tx Total Errors                ( )
  Tx Congestion Dropped Frames   ( )

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-6. E1/T1 Statistics*

*Table 6-2. E1/T1 Statistics*

| Parameter | Description |
|---|---|
| Rx Total Frames | The total number of frames received. |
| Rx Total Octets | The total number of octets (bytes) received |
| Rx Total Errors | The total number of errors received |
| Tx Total Frames | The total number of frames transmitted. |
| Tx Total Octets | The total number of octets (bytes) transmitted |
| Tx Total Errors | The total number of errors transmitted |
| Tx Congestion Dropped Frames | Total number of transmitted frames that are discarded due to a lack of buffer space |

## Displaying Logical Layer Statistics

The logical layer shows the statistics of the bundled E1 ports.

➤ **To view the Logical Layer statistics:**

- Navigate to Main › Monitoring › **Logical Layer**.

  The Logical Layer Statistics screen appears as illustrated in *Figure 6-7*. The statistics are described in *Table 6-3*.

➤ **To clear Logical Layer statistics:**

- In the Logical Layer Statistics menu, type **<1>** to clear the statistics.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Monitoring>Logical Layer

  Rx Total Frames                ( )
  Tx Total Frames                ( )
  Tx Congestion Dropped Frames   ( )
1. Clear Statistics

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-7. Logical Layer Statistics*

*Table 6-3. Logical Layer Statistics*

| Parameter | Description |
|---|---|
| Rx Total Frames | The total number of frames received. |
| Tx Total Frames | The total number of frames transmitted. |
| Tx Congestion Dropped Frames | Total number of transmitted frames that are discarded due to a lack of buffer space |

## 6.2 Handling Alarms and Traps

RICi-4E1/T1, RICi-8E1/T1 maintains a log file that can hold up to 1000 system messages. All events are time-stamped. *Table 6-4* lists the event types that appear in the event log.

### Displaying Events

➤ **To access the log file:**

RICi-4E1/T1, RICi-8E1/T1 has an integrated NTP client to enable receiving the date and the time from the network. If properly configured and an NTP server is available, all messages are recorded with time and date of occurrence, otherwise the date is 0000-00-00 and the time indicates the seconds that have elapsed since the system started.

1. Navigate to Main › Monitoring › System › **Log File**.

   The Log File screen appears as illustrated in *Figure 6-8*.

2. In the Log file screen, use the arrow keys to scroll the event list up and down, left and right.

```
                                    RICi-4E1
Main Menu>Monitoring>System>Log File

    Source       Description  Information   Severity Date        Time
1   E1 Port 2    LINK_DOWN    E1 port        Major    00-00-0000  00:00:01
2   E1 Port 6    LINK_UP      E1 port        Major    00-00-0000  00:00:02
3   Eth Port 1   LINK_DOWN    Eth port       Minor    00-00-0000  00:00:04

x - Clear Table
ESC-Previous menu; !-Main menu; &-Exit;  ?-help
```

*Figure 6-8. Typical Log File*

```
                                    RICi-4E1
Main Menu>Monitoring>System>Log File

    Source       Description  Information   Severity Date    Time
1   E1 Port 2    LINK_DOWN    E1 port        Major    04-07-1776 00:00:01
2   E1 Port 6    LINK_UP      E1 port        Major    02-06-1946 00:00:02
3   Eth Port 1   LINK_DOWN    Eth port       Minor    01-10-1949 00:00:04

x - Clear Table
ESC-Previous menu; !-Main menu; &-Exit;  ?-help
```

*Figure 6-9. Typical Log File after NTP becomes Available*

## Clearing Events

➤ To clear the log file

- In the Log File menu, type **x**.

*Table 6-4. Event List*

| Code | Event | Description |
|---|---|---|
| 10 | LINK_UP | Network Ethernet port has been connected |
| 20 | LINK_DOWN | Network Ethernet port has been disconnected |
| 40 | SNMP_AUTH_FAIL | SNMP Authentication Failure trap has been received |
| 50 | WEB_START | ConfiguRAD session has been initiated |
| 51 | WEB_ END | ConfiguRAD session has been finished |
| 52 | WEB_FAILURE | ConfiguRAD session has failed |
| 60 | TELNET_START | Telnet session has been initiated |
| 61 | TELNET_END | Telnet session has been finished |
| 62 | TELNET_FAILURE | Telnet session has failed |
| 70 | TFTP_START | TFTP session has been initiated |
| 71 | TFTP_ END | TFTP session has been finished |
| 72 | TFTP_FAILURE | TFTP session has failed |

| Code | Event | Description |
|---|---|---|
| 90 | TELNET_ACCESS_DENIED | Access via Telnet was denied, either because the current IP address does not appear in the manager list, or because disabled Telnet access. |
| 91 | WEB_ACCESS_DENIED | Access via Web was denied, either because the current IP address does not appear in the manager list, or because a user disabled Web access. |
| 92 | SNMP_ACCESS_DENIED | Access via SNMP was denied, either because the current IP address does not appear in the manager list, or because a user disabled SNMP access. |

## Traps Generated by RICi-4E1/T1, RICi-8E1/T1

RICi-4E1/T1, RICi-8E1/T1 sends SNMP traps to defined network management stations to report system events. Refer to *Table 6-5* for a list of the SNMP traps sent by RICi-4E1/T1, RICi-8E1/T1.

*Table 6-5. Trap List*

| Trap | Description | OID |
|---|---|---|
| coldStart | The unit has been restarted | 1.3.6.1.6.3.1.1.5.1 |
| authenticationFailure | User authentication has failed due to attempt to access device with wrong SNMP community | 1.3.6.1.6.3.1.1.5.5 |
| linkDown | Interface (Ethernet, E1/T1, or PPP) has been disconnected | 1.3.6.1.6.3.1.1.5.3 |
| linkUp | Interface (Ethernet, E1/T1, or PPP) has been connected | 1.3.6.1.6.3.1.1.5.4 |
| risingAlarm (RMON) | At least one TX congestion error was counted in a 10-second interval[1] | 1.3.6.1.2.1.16.0.1 |
| fallingAlarm (RMON) | No TX congestion error was counted in a 10-second interval[2] | 1.3.6.1.2.1.16.0.2 |
| dsx1LineStatusChange | E1/T1 status has changed (due to an E1/T1 alarm) | 1.3.6.1.2.1.10.18.15.0.1 |
| prtStatusChangeTrap | SFP module was removed or inserted | 1.3.6.1.4.1.164.6.1.0.3 |
| agnStatusChangeTrap | The device status has changed | 1.3.6.1.4.1.164.6.1.0.2 |
| tftpStatusChangeTrap | TFTP operation has successfully completed or has failed | 1.3.6.1.4.1.164.6.1.0.1 |

***Notes***

- *A falling alarm trap is sent between two rising alarm events.*
- *A rising alarm trap is sent between two falling alarm events.*

## 6.3 Troubleshooting

Use the chart in *Table 6-6* to identify and resolve problems.

*Table 6-6. Troubleshooting Chart*

| Fault | Probable Cause | Remedial Action |
|---|---|---|
| Power LED off | No power supplied to unit | 1. Check the power source.<br>2. Verify that the power cable is connected and correctly wired. |
| Ethernet Link LED off | • No Ethernet Link detected<br>• Ethernet port in switch and RICi-4E1/T1, RICi-8E1/T1 are not in the same rate or duplex mode | 1. Verify that the cable is connected and correctly wired.<br>2. Check switch and RICi-4E1/T1, RICi-8E1/T1 Ethernet port configurations such as negotiation, rate, and duplex mode.<br>3. Check events reported in the log file. |
| E1/T1 local or remote Sync Loss led on | No E1/T1 Link detected at the local or remote site | 1. Verify that the cable is connected and correctly wired.<br>2. Check the physical E1/T1 connection. Use loopbacks.<br>3. Check configuration of E1/T1 lines at local and remote sites.<br>4. Use Log File to check events. |
| No traffic flow between two units | Configuration or logical layer problems | 1. Use the System Interface Status screen for assistance. All active ports that show Activation–Up, should show Operation–Up.<br>2. Check events reported in the log file.<br>3. Check RICi-4E1/T1, RICi-8E1/T1 configuration and, if necessary, other RICi-4E1/T1, RICi-8E1/T1 parameters. |
| Partial Traffic Flow | Timing configuration is not properly set | 1. Check timing settings. |

## 6.4 Testing the Unit

RICi-4E1/T1, RICi-8E1/T1 checks network integrity by running ping, trace route, or loopback tests.

### Running a Ping Test

You can ping the remote IP host to check the IP connectivity.

➤ **To ping an IP host:**

1. Navigate to Main › Diagnostics › **Ping**.

   The Ping menu appears as illustrated in see *Figure 6-10*.

2. From the Ping menu, configure the following:
   - **Destination IP address**. IP address of the host that you intend to ping, 0.0.0.0 to 255.255.255.255.
   - **Number of frames to send**. Select **0** to send a continuous stream of frames, or 1-50 to send a specified number of frames.
3. Select **Send Ping** to start sending pings.

   The results are shown in the lower scrolling message window.
4. Select **Stop Ping** to stop the ping test.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Diagnostics>Ping

1. Destination IP Address                ... (0.0.0.0)
2. Number of Frames to Send [0 - 50]     ... (10)
3. Send Ping
4. Stop Ping

Please select item from 1 to 4
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-10. Ping Menu*

### Tracing the Route

This diagnostic utility traces the route through the network from RICi-4E1/T1, RICi-8E1/T1 to the destination host.

➤ **To trace a route:**

1. Navigate to Main menu›Diagnostics›**Trace Route**.
2. The Trace Route menu appears as illustrated in *Figure 6-11*.
3. From the Trace Route menu, select **Destination IP Address** and enter the IP address of the host to which you intend to trace the route.

4. Select **Display Trace Route** to start tracing.

   RICi-4E1/T1, RICi-8E1/T1 starts tracing the route displaying the IP addresses of all hop nodes.

5. Select **Stop Trace Route** to stop the tracing.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu>Diagnostics>Trace Route
1. Destination IP Address   …(0.0.0.0)
2. Display Trace Route
3. Stop Trace Route

Please select item from 1 to 3
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-11. Trace Route Menu*

## Performing a Loopback Test on E1/T1 Links

This diagnostic utility executes local loopback test on the E1/T1 links. The purpose of these loopback tests is to determine the source of a break in the data flow.

Loopbacks are not allowed on a live E1. It must be disconnected or administratively disabled before applying the loop. If not, a warning message will be displayed and the loop will not be performed.

➤ **To execute a loopback test on the E1/T1 links:**

1. Navigate to Main menu›Diagnostics› **Loopback**.
2. The E1 Loopback menu appears as illustrated in *Figure 6-12*.
3. Press **<f>** until the required port is reached.
4. Select the Loopback state as follows:
   - 1 - Remote: Perform remote loopback
   - 2 - Disable: Disable loopback testing.
5. Select **Time To Start** in seconds (0 – loop starts immediately).
6. Select **Duration** in seconds.

```
                          RICi-4E1
Main Menu>Diagnostics>Loopback
       Port                                (1)
    1. E1 Loopback State1                > Disable
    2. Time To Start (sec) [0-600]     ... (0)
    3. Duration (sec) [0-3600]         ... (1000)

f-Forward
ESC-Previous menu; !-Main menu; &-Exit
```

*Figure 6-12. E1 Loopback Menu*

## Performing Bit Error Rate Test (BERT)

You can perform a Bit Error Rate Test (BERT) to check that the E1/T1 physical layer is free of errors. RICi-4E1/T1, RICi-8E1/T1 transmits a bit pattern to another unit that provides a loopback. When the transmitting unit receives the bit pattern, it compares it to the sent bit pattern to determine the error rate.

➤ **To perform BERT:**

1. Navigate to the BERT menu (Main Menu > Diagnostics > **BERT**).
2. Type **f** or **b** to navigate to the E1/T1 port that you wish to test.
3. Define the pattern according to your testing requirements (see *Table 6-7*).
4. Select **Send BERT** and set it to **On** to start the test.

   The test starts. If errors occur, **Bit Error Count** indicates how many errors.
5. If desired, select **Inject Error** to inject an error.

   Indication of inject error is shown in the lower scrolling message window.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > BERT

   Port                                (1)
   Sync State                        > (Not Sync)
   Bit Error Count                     (0)
1. Pattern                           > (p2E15m1)
2. Send BERT                          (Off)
3. Inject Error

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-13. BERT Menu*

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > BERT

   Port                                (1)
   Sync State                        > (Not Sync)
   Bit Error Count                     (0)
1. Pattern                           > (p2E15m1)
2. Send BERT                          (Off)
3. Inject Error

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
------------------------------------------------------

Inject Error
Inject Error
```

*Figure 6-14. BERT Menu with Inject Error*

*Table 6-7. BERT Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Port | 1–Number of E1/T1 ports (4 or 8) | Index of E1/T1 port |
| Sync State | Not Sync<br>Sync | Indicates if the E1/T1 port is synchronized. This parameter is read-only and cannot be configured.<br>***Note**: The BERT is executed only if **Sync State** is **Sync**.* |
| Bit Error Count | 0-Number of bit errors | Indicates how many errors occurred in test. This parameter is read-only and cannot be configured |
| Pattern | p2E15m1<br>qrss<br>p2E11m1 | Specifies the bit pattern to send |
| Send BERT | On<br>Off | Set to **On** to start the test<br>Set to **Off** to stop the test. |
| Inject Error | | Select this to inject an error into the test. |

## Running OAM Tests

You can use loopback or link trace to test OAM connectivity and links.

### Performing OAM Loopback

This diagnostic utility verifies OAM connectivity on selected virtual Ethernet connections (flows). You can execute the loopback according to the destination address or the maintenance end point (MEP).

➤ **To verify OAM connectivity according to the destination address:**

1. Navigate to the OAM Tests Loopback menu (Main Menu > Diagnostics > **OAM Tests** > **Loopback** (see *Figure 6-15*).
2. Verify that **Destination Type** is set to **Destination Address**.

***Note***

- *If the destination address is all 0s or the number of loopbacks to send is 0, the **Send Loopbacks** parameter does not appear in the screen.*
- *The **Results** parameter appears after the loopbacks are sent.*

3. Define the test parameters according to *Table 6-8*.
4. Select **Send Loopback**s to send the specified number of loopbacks.

   The loopbacks are sent.
5. Select **Results**.
   - If you entered a Unicast MAC address (starts with 00), the Results screen appears as illustrated in *Figure 6-16*. The result parameters are described in *Table 6-9*.

- If you entered a Multicast MAC address:
  - The Results screen appears as illustrated in *Figure 6-17*. The result parameters are described in *Table 6-9*.
  - Select **Replied Addresses** to navigate to the Replied Addresses screen (see *Figure 6-18*).

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Loopback

1. Flow ID[1 - 8]                    ... (1)
   Flow Name                         ... (Put your string here)
2. Destination Type                      (Destination Address)
3. Destination Address               ... (00-11-B3-55-A6-77)
4. Number of LBs to Send[0 - 50]     ... (0)
5. Send Loopbacks
6. Results                           >

Please select item <1 to 4>
F-Forward; B-Backward
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-15. Loopback Menu – Destination Address*

*Table 6-8. Loopback Parameters – Destination Address*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | 1 – 8 | The ID of the virtual Ethernet connection. |
| Flow Name | | The name of the virtual Ethernet connection you chose.<br>***Note**: This parameter is read-only and cannot be configured.* |
| Destination Type | Destination Address<br>Remote MEP ID | The destination type for the loopback<br>**Default: Destination Address** |
| Destination Address | | The MAC address of the destination device |
| Number of LBs to Send | 0 – 50 | The number of loopbacks.<br>**Default: 0** |

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Loopback > Results

   Local MEP ID[1 - 8]              ... (1)
   Flow Name                        ... (Put your string here)
   Destination Address              ... (00-11-B3-55-A6-77)
   Messages Sent                    ... (14)
   Replys In-Order                  ... (14)
   Replys Out-of-Order              ... (0)
   Messages Lost/Timed out          ... (0)
   Messages Lost/Timed out %        ... (0)

>
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-16. Loopback Results Menu, Unicast MAC Address*

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Loopback > Results

   Local MEP ID[1 - 8]              ... (1)
   Flow Name                        ... (Put your string here)
   Destination Address              ... (01-C2-44-D5-66-7F)
   Replied MEPs                     ... (1)
1. Replied Addresses                []

>
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-17. Loopback Results Menu, Multicast MAC Address*

```
                        RICi-4E1/T1, RICi-8E1/T1
Main Menu> Diagnostics > OAM Tests > Loopback > Results > Replied Addresses

           MAC Address        Known as Rem. ID
         01-C2-44-D5-66-7F             2


>
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-18. Loopback Replied Addresses Menu, Multicast MAC Address*

*Table 6-9. Loopback Result Parameters*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Local MEP ID ID | 1 – 8 | The ID of the virtual Ethernet connection. |
| Flow Name | | The name of the virtual Ethernet connection you chose.<br>***Note**: This parameter is read-only.* |
| Destination Address | | The MAC address of the destination device |

| Parameter | Possible Values | Remarks |
|---|---|---|
| **Result Parameters for Unicast MAC Address** | | |
| Replys In-Order | | How many replies were received that were in order. |
| Replys Out-of-Order | | How many replies were received that were out of order. |
| Messages Lost/Timed out | | The number of messages that were lost or timed out |
| Messages Lost/Timed out % | | The percentage of messages that were lost or timed out |
| **Result Parameters for Multicast MAC Address** | | |
| Replied MEPs | | How many MEPs replied to loopback |
| MAC Address | | MAC address that sent reply to loopback |
| Known as Rem. Id | | Remote MEP ID that corresponds to the replying MAC address |

➤ **To verify OAM connectivity according to the Remote MEP IDs:**

1. In the OAM Tests Loopback menu, set **Destination Type** to **Remote MEP ID**.

   Remote MEP parameters appear as illustrated in *Figure 6-19*.

***Note*** *If the number of loopbacks to send is 0, the **Send Loopbacks** parameter does not appear in the screen.*

2. Define the test parameters according to *Table 6-10*.
3. Select **Send Loopbacks** to send the specified number of loopbacks.

   The loopbacks are sent.

4. Select **Results**. The result parameters are described in *Table 6-9*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Loopback

1. Flow ID[1 - 8]                    ... (1)
   Flow Name                         ... (No such flow)
2. Destination Type                      (Remote MEP ID)
3. Remote MEP ID[1 - 8191]           ... (0)
   Remote MEP Address                ... (00-00-00-00-00-00)
4. Number of LBs to Send[0 - 50]     ... (0)
5. Send Loopbacks
6. Results                           >

Please select item <1 to 4>
F-Forward; B-Backward
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-19. Loopback Menu – Remote MEP ID*

*Table 6-10. Loopback Parameters – Remote MEP ID*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | 1 – 8 | The ID of the virtual Ethernet connection. |
| Flow Name | | The name of the virtual Ethernet connection you chose.<br>***Note**: This parameter is read-only.* |
| Destination Type | Destination Address<br>Remote MEP ID | The destination type for the loopback<br>**Default: Destination Address** |
| Remote MEP ID | 1 – 8191 | ID of the remote maintenance endpoint, terminating the maintenance entity. It must be different from the local MEP ID and unique for the maintenance domain. If set to **0**, no maintenance end point (MEP) is assigned.<br>**Default: 0** |
| Remote MEP Address | | The MAC address of the device assigned as media point at the remote location.<br>***Note:** This parameter is read-only. It is automatically updated by the system when you enter a valid remote MEP ID.* |
| Number of LBs to Send | 0 – 50 | The number of loopbacks to send.<br>**Default: 0** |

## Performing OAM Link Trace

This diagnostic utility traces the OAM route to the destination, specified either by the MAC address or the maintenance end point (MEP). You can use maintenance end point (MEP) specification only in standard OAM mode.

➤ **To trace OAM route according to the target MAC address:**

1. From the OAM Tests menu (Main Menu > Diagnostics > **OAM Tests**), select **Link Trace**.

   The Link Trace menu appears (see *Figure 6-20*).

2. Verify that **Destination Type** is set to **Target MAC Address**.

***Note*** *If the target MAC address is all 0s, the **Send Link Trace** parameter does not appear in the screen.*

3. Define the test parameters according to *Table 6-11*.
4. Select **Send Link Trace** to perform the link trace.
5. Select **Results** to view the results of the link trace, as illustrated in *Figure 6-21*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Link Trace

1. Flow ID[1 - 8]                      ... (1)
   Flow Name                           ... (Put your string here)
2. Destination Type                        (Target MAC Address)
3. Target MAC Address                  ... (00-00-00-00-00-00)
4. TTL[1 - 64]                         ... (64)
5. Send Link Trace
6. Results                             []

Please select item <1 to 4>
F-Forward; B-Backward
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-20. Link Trace Menu – Target MAC Address*

*Table 6-11. Link Trace Parameters – Target MAC Address*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | 1 – 8 | The ID of the virtual Ethernet connection. |
| Flow Name | | The name of the virtual Ethernet connection you chose.<br>***Note**: This parameter is read-only.* |
| Destination Type | Target MAC Address<br>Target MEP ID | The destination type for the link trace<br>**Default: Target MAC Address** |
| Target MAC Address | | The target MAC address of the link trace |
| TTL | 1–64 | This is used to limit the number of hops to 64. The first unit to initiate the trace sets this to 64, then each unit in the trace decrements it..<br>**Default: 64** |

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Link Trace > Results

  HOP   MAC Address    ING/EGR Action  Port ID     Relay Action
  1     0020C0010203     IngOK          MLPPP 1      RlyHit
  1     0020C0010203     EgrOK          MLPPP 1      RlyHit
  2     0020C0010608     IngOK          MLPPP 1      RlyHit
  2     0020C0010608     EgrOK          MLPPP 1      RlyHit

ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-21. Link Trace Results*

➤ **To trace OAM route according to the target MEP ID:**

1. In the OAM Tests Link Trace menu, set **Destination Type** to **Target MEP ID**.

   MEP parameters appear as illustrated in *Figure 6-22*.

***Note*** *If the target MEP address is all 0s, the **Send Link Trace** parameter does not appear in the screen.*

2. Define the test parameters according to *Table 6-12*.
3. Select **Send Link Trace** to perform the link trace.
4. Select **Results** to view the result of the link trace, as illustrated in *Figure 6-21*.

```
                    RICi-4E1/T1, RICi-8E1/T1
Main Menu > Diagnostics > OAM Tests > Link Trace

1. Flow ID[1 - 8]                    ... (1)
   Flow Name                         ... (Put your string here)
2. Destination Type                      (Target MEP ID)
3. Target MEP ID[1 - 8191]           ... (0)
   Target MEP Address                ... (00-00-00-00-00-00)
4. TTL[1 - 64]                       ... (64)
5. Send Link Trace
6. Results                           []

Please select item <1 to 5>
F-Forward; B-Backward
ESC-Previous menu; !-Main menu; &-Exit; ?-Help
```

*Figure 6-22. Link Trace Menu – Target MEP ID*

*Table 6-12. Link Trace Parameters – Target MEP ID*

| Parameter | Possible Values | Remarks |
|---|---|---|
| Flow ID | 1 – 8 | The ID of the virtual Ethernet connection. |
| Flow Name | | The name of the virtual Ethernet connection you chose.<br>***Note**: This parameter is read-only and cannot be configured.* |
| Destination Type | Target MAC Address<br>Target MEP ID | The destination type for the link trace<br>**Default: Target MAC Address** |
| Target MEP ID | | ID of the remote maintenance endpoint, terminating the maintenance entity. It must be different from the local MEP ID and unique for the maintenance domain. If set to **0**, no maintenance end point (MEP) is assigned.<br>**Default: 0** |
| Target MEP Address | | The MAC address of the device assigned as media point at the target location.<br>***Note**: This parameter is read-only. It is automatically updated by the system when you enter a valid target MEP ID.* |
| TTL | 1–64 | This is used to limit the number of hops to 64. The first unit to initiate the trace sets this to 64, then each unit in the trace decrements it..<br>**Default: 64** |

## 6.5 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the RAD distributor nearest you or one of RAD's offices worldwide. This information can be found at www.rad.com. (Offices – About RAD › Worldwide Offices; Distributors – Where to Buy › End Users).

# Appendix A
# Connector Wiring

## A.1 Ethernet Connector

The 10/100BaseT Ethernet electrical interface is an 8-pin RJ-45 connector, wired in accordance with *Table A-1*.

*Table A-1. 10/100BaseT Ethernet Connector Pinouts*

| Pin | Function |
|---|---|
| 1 | Tx+ |
| 2 | Tx– |
| 3 | Rx+ |
| 4, 5 | – |
| 6 | Rx– |
| 7, 8 | – |

## A.2 E1/T1 Connector

The E1 or T1 electrical interface is an 8-pin RJ-45 connector, wired in accordance with *Table A-2*.

*Table A-2. E1 or T1 Connector Pinouts*

| Pin | Function |
|---|---|
| 1 | Rx+ |
| 2 | Rx– |
| 3 | NC |
| 4 | Tx+ |
| 5 | Tx– |
| 6 | NC |
| 7 | NC |
| 8 | NC |

***Note*** *Do not connect wires to the NC pins.*

## A.3 Control Connector

The control terminal interface terminates in a V.24/RS-232 9-pin D-type female DCE connector. *Table A-3* lists the control connector pin assignments.

*Table A-3. CONTROL Connector Pinout*

| Pin | Function |
|---|---|
| 1 | Data Carrier Detect (DCD) |
| 2 | Receive Data (RD) |
| 3 | Transmit Data (TD) |
| 4 | Data Terminal Ready (DTR) |
| 5 | Ground (GND) |
| 6 | Data Set Ready (DSR) |
| 7 | Request to Send (RTS) |
| 8 | Clear to Send (CTS) |
| 9 | Ring Indication (RI) |

# Appendix B

# Boot Sequence and Downloading Software

This appendix provides a description of the RICi-4E1/T1, RICi-8E1/T1 boot procedure via an ASCII terminal for downloading software.

The RICi-4E1/T1, RICi-8E1/T1 software is stored in flash memory in two sections, in the boot sector and in the file system. The boot sector holds a boot program that calls up the rest of the program from the file system.

The file system can hold two compressed copies of the RICi-4E1/T1, RICi-8E1/T1 code. One copy is called the operating file, and the other is called the backup file. The operating file is the default-executable RICi-4E1/T1, RICi-8E1/T1 code. The backup file is used whenever the operating file is absent or corrupted.

## B.1 Booting RICi-4E1/T1, RICi-8E1/T1

RICi-4E1/T1, RICi-8E1/T1 boots up automatically. After powering up, no user intervention is required, except when the user wants to access the file system to modify or update the software or the RICi-4E1/T1, RICi-8E1/T1 configuration.

### Accessing the Boot Manager

The Boot Manager menu is an option that allows the user to perform basic file transfer operations. These operations are all optional.

➤ **To access the Boot Manager menu:**

- Press **<Enter>** several times immediately after starting RICi-4E1/T1, RICi-8E1/T1.

  The Boot Manager menu is displayed as illustrated in *Figure B-1*.

```
RICi-4E1/T1, RICi-8E1/T1 Boot Version 1.00 (Jan 20 2005)
Boot manager version 7.02 (Jan 20 2005)

0 - Exit Boot-Manager
1 - Dir
2 - Set Active Software Copy
3 - Delete Software Copy
4 - Download an Application by XMODEM
5 - Format flash
6 - Show basic hardware information
7 - Reset board
8 - System Configuration.
9 - Download an Application by TFTP
Press the ESC key to return to the Main Menu.
Select:
```

*Figure B-1. Typical Boot Manager Menu*

From the Boot Manager menu, you can do the following:

- Listing all files stored in the flash memory
- Exchanging the operating and backup files
- Deleting the operating file; the backup file becomes the operating file
- Downloading a new operating file via XMODEM; the previous operating file is saved as the backup file
- Deleting all software and configuration files
- Displaying the basic hardware information (RAM, ROM size etc)
- Resetting the RICi-4E1/T1, RICi-8E1/T1 board
- Configuring the RICi-4E1/T1, RICi-8E1/T1 IP address, IP mask, and default gateway for the consecutive file download via TFTP.

If you choose to exchange or delete a file, you are prompted for confirmation.

## B.2 Transferring the Software and Configuration Files

New software releases are distributed as separate files, which are downloaded to RICi-4E1/T1, RICi-8E1/T1 using the XMODEM protocol or TFTP from the Boot Manager menu. Alternatively, you can download a new software release via TFTP, when the RICi-4E1/T1, RICi-8E1/T1 management software is already running (**Main menu** > **Utilities** > **File Transfer**).

The TFTP protocol can also be used for uploading configuration files that contain the RICi-4E1/T1, RICi-8E1/T1 databases to the management station. When RICi-4E1/T1, RICi-8E1/T1 is running, administrators can use this capability to distribute verified configuration files to all other units that use the similar configuration.

### Downloading Application Files via XMODEM

Downloading application files using the XMODEM protocol is performed from the Boot Manager menu.

➤ **To download an application file via XMODEM:**

1. Configure your ASCII terminal or terminal emulation utility running on your PC to the 115.2 kbps data rate.
2. Access the Boot Manager menu.

   The Boot Manager menu appears as illustrated in *Figure B-1*.
3. From the Boot Manager menu, select **Download Files or an Application by XMODEM**.

   RICi-4E1/T1, RICi-8E1/T1 displays the following message:
   **`Select Copy number for download (0)`**
4. Select the backup partition by typing its number, **0** or **1**.

   RICi-4E1/T1, RICi-8E1/T1 responds with the following string:
   **`Please start the XMODEM download.`**
5. Send the software release file to RICi-4E1/T1, RICi-8E1/T1 using the XMODEM utility of you terminal application.

   Once the downloading is completed, RICi-4E1/T1, RICi-8E1/T1 saves the new release as an active partition, the former active partition turns into backup, and the boot sequence continues normally.

   If a failure occurs during the download, the partially downloaded software is erased. In this case, only active software is left in the flash memory.

## Downloading Application Files via TFTP

➤ To download application file via TFTP

1. From the Boot Manager menu, select System Configuration.
2. Configure the IP parameters of RICi-4E1/T1, RICi-8E1/T1 (IP address, IP mask, and default gateway). These parameters are valid only for the TFTP file transfer via the Boot Manager.
3. Start a TFTP application.
4. Configure the TFTP communication parameters as follows:
   - Connection timeout – more than 30 seconds to prevent an automatic disconnection wile deleting the backup partition, which takes about 25 seconds.
   - Block size – 512 bytes.
   - UDP port – 69.
5. Select a local software release file to download.
6. Enter the TFTP server IP address.
7. Start downloading.

   RICi-4E1/T1, RICi-8E1/T1 automatically erases the backup partition (it takes about 25 seconds). Once the downloading is completed, the RICi-4E1/T1, RICi-8E1/T1 unit saves the new release as an active partition; the previously active partition becomes a backup.

# Appendix C

# Operation, Administration, and Maintenance (OAM)

This appendix describes the Ethernet OAM functionality of RICi-4E1/T1, RICi-8E1/T1.

## C.1 Introduction

Currently RICi-4E1/T1, RICi-8E1/T1 support pre-standard implementation of Ethernet OAM based on Y.1731 and standard implementation based on Y.1731 and IEEE P802.1ag. The pre-standard implementation is used only for performance measurements when using two RAD units working opposite each other or when working opposite a RAD device with an older version of RAD Ethernet OAM. This appendix describes the pre-standard implementation. The standard implementation can be found in Y.1731 and IEEE P802.1ag.

RICi-4E1/T1, RICi-8E1/T1 have the following capabilities for providing operation, administration, and maintenance (OAM) in packet-switched networks:

- Continuity check
- Non-intrusive loopback which used to detect loss of bidirectional continuity
- Performance measurements (per service).

*Table C-1* lists the Ethernet OAM-related terms used in this appendix.

*Table C-1. Ethernet OAM Terminology*

| Term | Description |
|---|---|
| UNI | User Network Interface. The physical demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber |
| UNI_C | Customer side of a UNI link |
| UNI_N | Network side of a UNI link |
| Service frame | An Ethernet frame transmitted across the UNI toward the Service Provider or an Ethernet frame transmitted across the UNI toward the Subscriber. |

| Term | Description |
|---|---|
| Flow | Ethernet Virtual Connection : An association of two or more UNIs that limits the exchange of Service Frames to UNIs in the Ethernet Virtual Connection |
| Point-to-point Flow | Flow connecting exactly two UNIs |
| Multipoint-to-Multipoint Flow | Flow connecting two or more UNIs |
| Service Instance / Class of service (CoS) | A set of Service Frames that have a commitment from the Service Provider to receive a particular level of performance |
| Service Instance Identifier (CoS ID) | Service Frame delivery performance is specified for all Service Frames transported within a flow with a particular Class of Service instance. The Class of Service instance is identified by a Class of Service Identifier associated with each Service Frame (Class of service can be identified by more than one parameter/frame attribute) |
| MEP | Proactive OAM reference point which is capable to initiate and terminate proactive OAM frames. MEP is also capable to initiate and react to diagnostics OAM frames. |
| MIP | A provisioned OAM reference point which is capable to respond to diagnostics OAM frames initiated by the MEP. |
| MEP Service Instance Source | The receiver of OAM frames in each Service Instance |
| MEP Service Instance Destination | The transmitter of OAM frames in each Service Instance |

## C.2 Reference Architecture

*Figure C-1* illustrates two OAM flows:

- OAM flow originating from the CPE

  The CPE-to-CPE OAM flow is transferred transparently by RICi-4E1/T1, RICi-8E1/T1 and treated as data.

- OAM flow originating from the RICi-4E1/T1, RICi-8E1/T1 devices.

  The RICi-4E1/T1, RICi-8E1/T1 OAM flow runs on a data flow on the same VLAN.
  The RICi-4E1/T1, RICi-8E1/T1 units terminate the OAM flow and can be referred as a Maintenance Entity (ME). Each device supports up to eight such MEs. In this case, the RICi-4E1/T1, RICi-8E1/T1 units act as MEPs (Maintenance End-Points) and not as MIPs (Maintenance Intermediate Points), and all measurements are performed on the UNI_N to UNI_N segment.

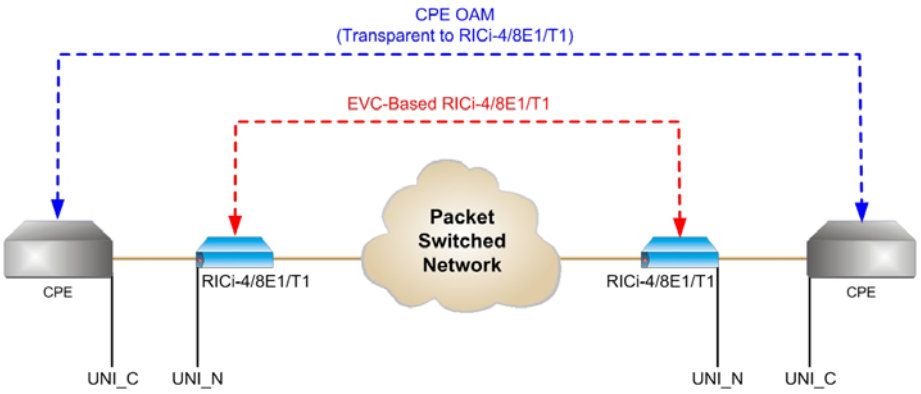



*Figure C-1. OAM Architecture*

## Handling of OAM Levels

### UNI_C to UNI_N Direction

In the UNI_C to UNI_N direction RICi-4E1/T1, RICi-8E1/T1 block all OAM messages with OAM level greater than 2. Messages with other OAM levels are passed transparently.

### Network Ingress to UNI_N Direction

All OAM messages coming from the network ingress with the ETX MAC address or with the special OAM multicast address are sent to the CPU. All other OAM messages are passed transparently to the user ports as per the respective flow definition.

## C.3 OAM Entities

This section describes the OAM entities hierarchy. *Figure C-2* illustrates the relationship between UNI, flow, and Service Instance (COS ID), when one or more service instances belong to one flow and one or more flows belong to a UNI. From the OAM perspective, the continuity messages and defects are activated per flow, and the PM is activated per service instance.

***Note*** *A flow can belong only to one UNI in the same RICi-4E1/T1, RICi-8E1/T1.*

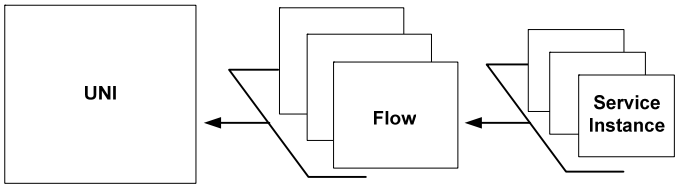



*Figure C-2. UNI, Flow, and Service Instance (COS ID)*

*Figure C-3*, *Figure C-4*, and *Figure C-5* illustrate different combinations of UNIs, flows, and service instances. Each UNI contains at least one flow, which contains at least one service instance.

- In case of one flow per UNI (*Figure C-3*), the PM and CC are transmitted once.

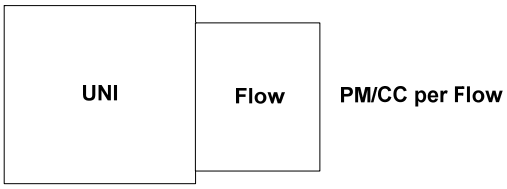



*Figure C-3. One Flow per UNI*

- In case of multiple flows per UNI (*Figure* C-4), PM and CC are transmitted three times.

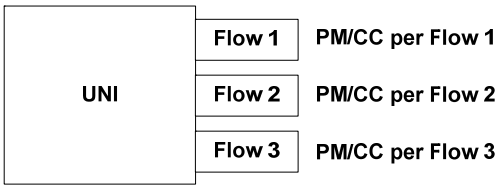



*Figure C-4. Multiple Flows per UNI*

- In case of one flow and multiple CoS (Service Instances) per UNI (*Figure C-5*), the PM is transmitted three times and the CC is transmitted once.

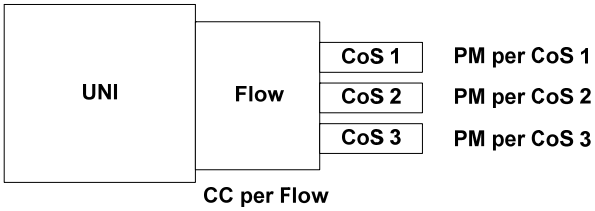



*Figure C-5. One Flow and Multiple CoS (Service Instances) per UNI*

## C.4 OAM Flows

*Figure C-6* illustrates a typical OAM traffic flow. The OAM message is transmitted from the source MEP 1 to the destination MEP 2 and the reply is transmitted back The source is also a destination for messages from the other direction.

The OAM interval is one second, so each NTU transmits one request and one reply and receives one request and one reply. A total of four messages are transmitted per second per service instance.

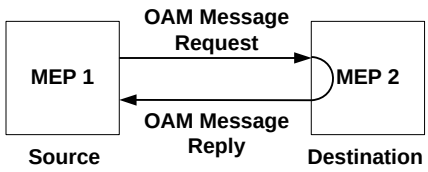



*Figure C-6. OAM Flow*

## OAM Messages Addressing

The OAM defines two modes of addressing, unicast and multicast. Unicast addressing is used for point-to-point connections, while multicast addressing is used in cases where the MAC address of the destination MEP is not known. Currently RICi-4E1/T1, RICi-8E1/T1 supports point-to-point flows only.

## OAM Message Association

On the receiver side the OAM frame is associated with a flow and a service.

### Flow Association

When an OAM frame is associated with a flow, the following steps are performed:

- Request message reception

  When a request message is received, the VLAN is extracted to find the Flow ID. The Flow ID found at the receiver is compared against the Flow ID in the frame. If the IDs are equal, further service association is made. If it is not found, the "Flow ID no match" notification is returned in the reply message.

- Reply message reception

  When a reply message is received, the VLAN is extracted to find the Flow ID. The Flow ID found at the receiver is compared against the Flow ID in the frame. If the IDs are equal, further service association is made. If it is not found, the frame is discarded and connectivity alarm is issued.

### Service Association

When an OAM frame is associated with a service, the following steps are performed:

- Request message reception

  The class of service characteristics are extracted from the frame and must be matched to an entry in the flows <-> services table at the receiver. If they are matched, the frame is processed. If not, the service ID is returned with the "Not Found" notification.

- Reply message reception

  The class of service characteristics are extracted from the frame and must be matched to an entry in the flow <-> services table at the receiver. If they are matched, the frame is processed. If not, the frame is discarded.

## Ethernet Loopback (ETH-LB)

The ETH-LB can be used to verify connectivity. The ETH-LB is performed by sending a request ETH-LB message to the remote unit and expecting an ETH-LB reply message back to verify connectivity. When the insertion rate of ETH-LB messages is much slower compared to data rate between the flow points, ETH-LB is suitable to perform in-service connectivity verification and to measure round trip delays.

The message is initiated by the local device and runs periodically making it suitable for fault detection.

Unicast ETH-LB request message is sent from a MEP to a specific MEP (remote device). The DA of the request message is a unicast MAC address of destination device. Upon receipt of the request message, the MEP responds with unicast ETH-LB reply message. The DA of the reply message is a unicast MAC address of requesting device, learned from request message.

## Continuity Check (ETH-CC)

Ethernet Continuity Check (ETH-CC) can be used to detect continuity failures across flows between a given pair of edge service point on a flow. Continuity failures are caused by:

- Major failures (link failure, device failure, network path failure etc)
- Minor failures (software failure, memory corruption, incorrect configuration etc).

The ETH-CC signal is generated by one MEP. Upon receipt of the first ETH-CC signal from a sending MEP, the receiving MEP detects continuity with sending MEP and expects to receive further periodic ETH-CC signals. Once the receiving MEP stops receiving periodic ETH-CC signals from sending MEP, it declares continuity failure. The MEP that detects the continuity failure notifies the operator by sending an alarm or a trap.

## OAM Procedures

This section discusses the continuity check (CC) and the performance measurement (PM) procedures.

### Continuity Check Procedure

The loopback message and the ETH-CC messages are used for continuity check. In case the services are defined and PM collection is enabled, they are also used to carry PM messages. If PM collection is disabled, the messages are used for continuity check only.

If the RX CC mode of the receiver is configured to CC-based, the continuity detection is based on ETH-CC. If the mode is set to LB-based, the continuity detection is based on ETH-LB. If the mode is disabled, the continuity detection is not performed.

#### *ETH-LB Method*

The ETH-LB method includes the following elements:

- Unicast ETH-LB transmission

  Unicast ETH-LB request message is transmitted by a MEP (RICi-4E1/T1, RICi-8E1/T1) every second. The transmitted Transaction Identifier is retained for at least five seconds after the unicast ETH-LB signal is transmitted. The Transaction Identifier must be changed for every unicast ETH-LB message, and no Transaction Identifier from the same MEP is allowed to be repeated within 1 minute.

- Unicast ETH-LB reception and reply transmission

  Whenever a valid unicast ETH-LB request message is received by a MEP (RICi-4E1/T1, RICi-8E1/T1), a unicast ETH-LB reply message is generated and transmitted to the requesting MEP. Every field in the unicast ETH-LB request message is copied to the unicast ETH-LB reply message with the following exceptions:

  - The source and destination MAC addresses are swapped
  - The OpCode field is vendor-specific oxFE
  - The Flow and MEP ID are processed as follows: if the Flow/MEP ID do not exist in the device, it changes them to No Match" otherwise they are left intact.

- Unicast ETH-LB reply receipt

  When a unicast ETH-LB reply message is received by a MEP (RICi-4E1/T1, RICi-8E1/T1) diagnostic flow termination function, it examines the TLVs returned in the unicast ETH-LB reply message. The signal is declared invalid if the TLVs do not match those sent in the corresponding unicast ETH-LB request signal, including MEP ID and Flow ID.

- Continuity declarations

  Loss of Continuity and Connectivity Mismatch states are declared by the ETH-LB mechanism.

  - Loss of continuity declaration

    After the source device sends an ETH-LB message a timer is set with a 3.52 second timeout. If the destination device does send reply within the timeout, the source enters the loss of continuity state. Upon reply from the destination, the source resets the timer to 23.5 seconds. Regarding the continuity check message, the source checks only the Flow ID with the MEP ID. When the source enters the loss of continuity state, it adds 24 to Unavailable Seconds counter. The 23.5 second period is calculated as a sliding window.

    Loss of continuity state is cleared after 3.52 seconds with at least 21 reply messages from the destination. In this case the Unavailable Seconds counter is decremented by 24.

  - Connectivity mismatch declaration

    If the source Flow ID is not equal to the destination Flow ID as recorded in the reply message for 10 consecutive times, the source enters in to misconnection state.

    Misconnection state is cleared after 10 consecutive reply messages with the correct flow name from the destination.

    The Unavailable counter is maintained by the service according to the number of PM messages that did not receive replies. If a mismatch notification is received to the LB request, the frame is dropped and reply message is not sent. This is why the service becomes unavailable (no reply) in case of mismatch and the unavailable counter is raised.

### *ETH-CC Method*

The ETH-CC method includes the following elements:

- ETH-CC transmission

  Unicast ETH-CC request message is transmitted by a MEP (RICi-4E1/T1, RICi-8E1/T1) every 1 second. The transmitted Transaction Identifier is retained for at least 5 seconds after the unicast ETH-CC signal is transmitted. The Transaction Identifier must be changed for every Unicast ETH-CC message, and no Transaction Identifier from the same MEP is allowed to be repeated within 1 minute.

- Unicast ETH-CC reply receipt

  When a unicast ETH-CC message is received by a MEP (RICi-4E1/T1, RICi-8E1/T1) diagnostic flow termination function, it examines the TLVs returned in the unicast ETH-CC message, and declares the signal invalid if the TLVs do not match those sent in the corresponding exiting MEP ID and Flow ID.

- Continuity declarations

  Loss of Continuity and Connectivity Mismatch states are declared by the ETH-CC mechanism.

  - Loss of continuity declaration

    When the MEP receives the ETH-CC message a timer is set with a 3.5 seconds timeout. If the source does send another message during this period, the destination enters the loss of continuity state. Upon receipt of the ETH-CC message, the destination resets the timer to 3.5 seconds. Regarding the continuity check message, the destination check the Flow ID and the MEP ID. When the destination enters the loss of continuity state, it adds 4 to the Unavailable Seconds counter. The 3.5 second period is calculated as a sliding window.

    Loss of continuity state is cleared after 3.5 seconds with at least 2 messages from the source. In this case the Unavailable Seconds counter is decreased by 4.

  - Connectivity mismatch declaration

    If the source Flow ID is not equal to the destination Flow ID for 10 consecutive times, the destination enters in to misconnection state.

    Misconnection state is cleared after 10 consecutive reply messages with the correct flow name from the source.

    The Unavailable counter is maintained by the service according to the number of PM messages that did not receive replies. If a mismatch notification is received to the LB request, the frame is dropped and reply message is not sent. This is why the service becomes unavailable (no reply) in case of mismatch and the unavailable counter is raised.

## Performance Measurement

RICi-4E1/T1, RICi-8E1/T1 measure performance in 15-minute intervals. The units also store performance history data for the last 24 hours (96 intervals). *Table C-2* lists the PM counters supported by RICi-4E1/T1, RICi-8E1/T1.

*Table C-2. Performance Measurement Counters*

| Parameter | Description |
|---|---|
| Frames Above Delay Obj. | Number of frames that exceeded delay objective |
| Frames Below Delay Obj. | Number of frames below or equal delay objective |
| Frames Above DV Obj. | Number of frames that exceeded delay variation objective |
| Frames Below DV Obj. | Number of frames below or equal delay variation objective |
| Frames Transmitted | Total number of OAM frames transmitted in the current interval |
| Frames Lost | Number of frames lost in the current interval |
| Unavailable Seconds | Number of seconds during which the service was unavailable in the current interval |
| Elapsed Time | Time (in seconds) elapsed from beginning of the interval 0–900 |
| Min. RT Delay | Minimum round trip delay (in mseconds) calculated in the interval (or up to elapsed time in current interval) |
| Avg. RT Delay | Average round trip delay (in mseconds) calculated in the interval (or up to elapsed time in current interval) |
| Max. RT Delay | Maximum round trip delay (in mseconds) calculated in the interval (or up to elapsed time in current interval) |
| Avg. DV | Average delay variation (in mseconds) calculated in the interval (or up to elapsed time in current interval) |
| Max. DV | Maximum delay variation (in mseconds) calculated in the interval (or up to elapsed time in current interval) |
| OAM Transmitted Frames Counter | Total number of OAM frames transmitted since the service was enabled |
| OAM Frames Loss Counter | Total number of OAM frames lost since the service was enabled |
| OAM Frame Loss Ratio | Total number of lost OAM frames divided by total number of transmitted OAM frames since the service was enabled |
| Elapsed Time | Time (in seconds) elapsed since the service was enabled |
| Unavailable Seconds | Total number of unavailable seconds since the service was enabled |
| Unavailability Ratio | Total number of unavailable seconds divided by elapsed time |

## C.5 RMON Statistics

In addition to the regular statistics collection, RICi-4E1/T1, RICi-8E1/T1 supports proactive SLA measurements per RICi-4E1/T1, RICi-8E1/T1 port, as per RMON-based RFC 2819. The device sends reports when one of the available counters (physical layer or OAM) rises above or drops below the set thresholds within the specified sampling period of time. These reports can be sent as SNMP traps to the defined network management stations or be written to the event log.

The following counters can be monitored:

- Dropped Frames
- Undersize Frames
- Oversize Frames
- Fragmented Frames
- Jabbers
- Frame Loss Ratio
- Frames Above Delay
- Frames Above Delay Variation
- Unavailability Ratio.

Supplement

# AC/DC Adapter (AD) Plug

## for DC Power Supply Connection

***Note*** *Ignore this supplement if the unit is AC-powered.*

Certain units are equipped with a wide-range AC/DC power supply. These units are equipped with a standard AC-type 3-prong power input connector located on the unit rear panel. This power input connector can be used for both AC and DC voltage inputs.

For DC operation, a compatible straight or 90-degree AC/DC Adapter (AD) plug for attaching to your DC power supply cable is supplied with your RAD product (see *Figure 1* and *Figure 2*).

Connect the wires of your DC power supply cable to the AD plug, according to the voltage polarity and assembly instructions provided on *page 2*.

*Figure 1. Straight AD Plug*

*Figure 2. 90-Degree AD Plug*

***Caution***

Prepare all connections to the AD plug **before** inserting it into the unit's power connector.

Publication No. SUP-930-07/08

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➤ **To prepare the AD plug and connect it to the DC power supply cable:**

1. Loosen the cover screw on the bottom of the AD plug to open it (see *Figure 3*).
2. Run your DC power supply cable through the removable cable guard and through the open cable clamp.
3. Place each DC wire lead into the appropriate AD plug wire terminal according to the voltage polarity mapping shown. Afterwards, tighten the terminal screws closely.
4. Fit the cable guard in its slot and then close the clamp over the cable. Tighten the clamp screws to secure the cable.
5. Reassemble the two halves of the AD plug and tighten the cover screw.
6. Connect the assembled power supply cable to the unit.

***Note**: You have to flip over the non-90-degree AD plug type by 180 degrees to insert it into the unit. After inserting it, verify that the blue (negative) wire is connected to the POWER and the brown (positive) wire is connected to the RETURN.*

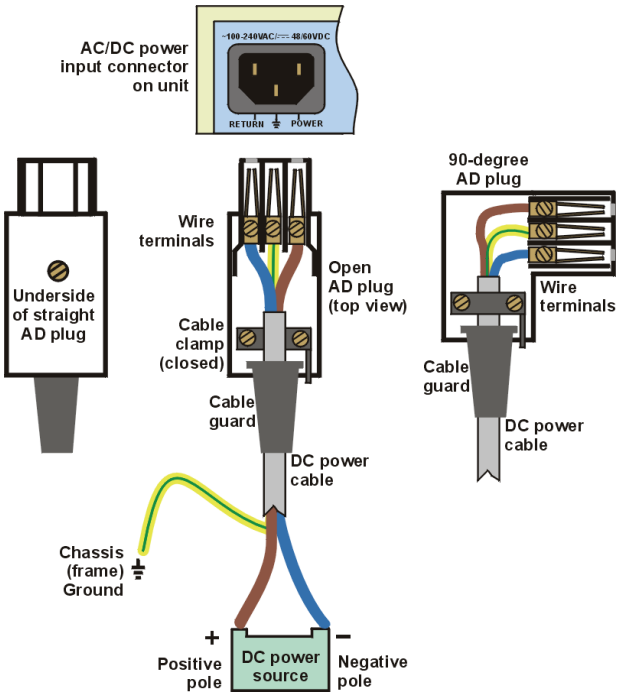


*Figure 3. AD Plug Details*

***Warning***

- **Reversing the wire voltage polarity will not cause damage to the unit, but the internal protection fuse will not function.**
- **Always connect a ground wire to the AD plug's chassis (frame) ground terminal. Connecting the unit without a protective ground, or interrupting the grounding (for example, by using an extension power cord without a grounding conductor) can damage the unit or the equipment connected to it!**
- **The AD adapter is not intended for field wiring.**

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# Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

**Manual Name:** RICi-4E1/T1, RICi-8E1/T1 Ver. 2.0

**Publication Number:** 456-200-11/08

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| Operating instructions | ❒ | ❒ | ❒ | ❒ | ❒ |
| Manual organization | ❒ | ❒ | ❒ | ❒ | ❒ |
| Illustrations | ❒ | ❒ | ❒ | ❒ | ❒ |
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